

COAL AGE

A MCGRAW-HILL PUBLICATION

DECEMBER, 1958

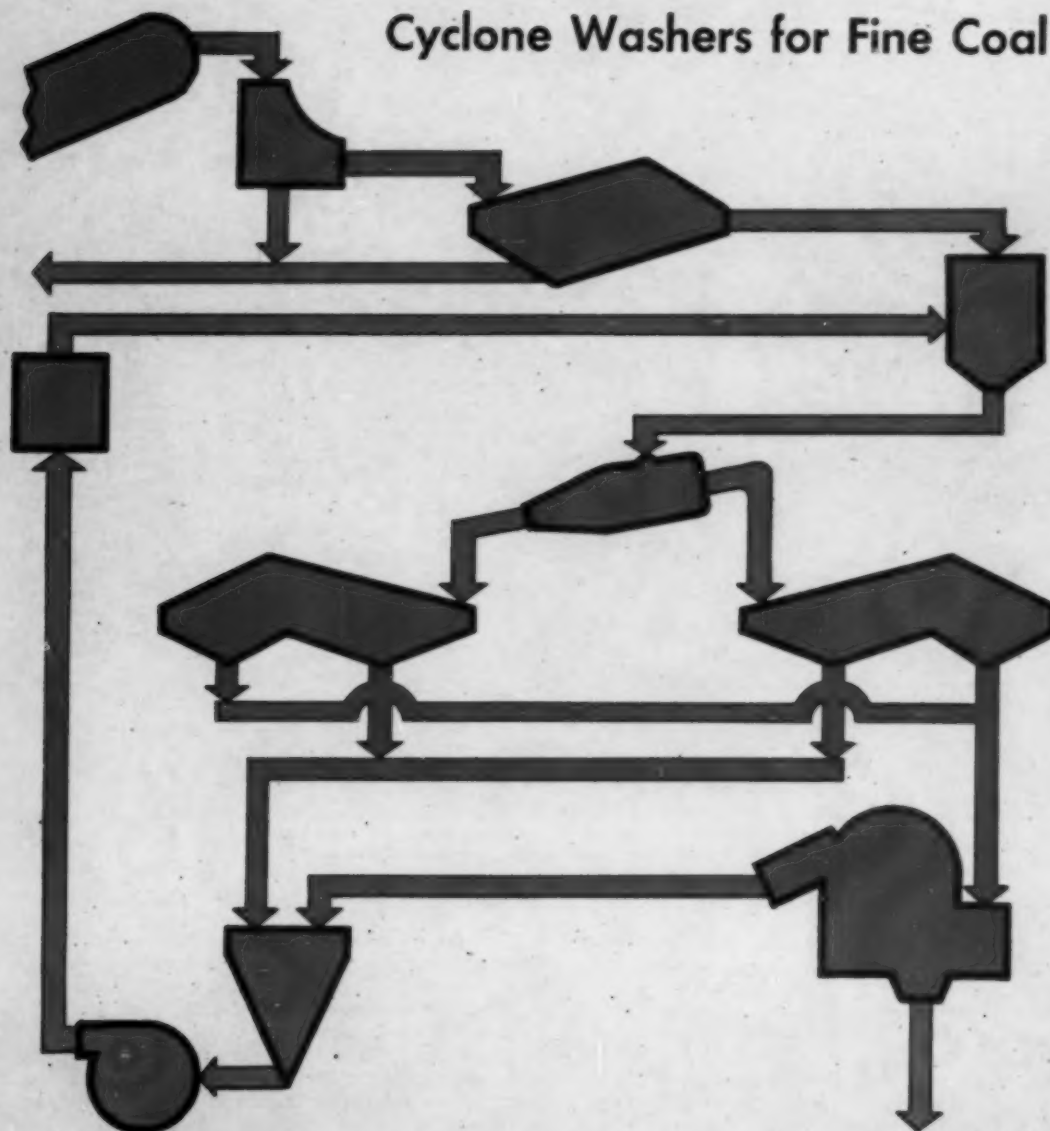
BCR's Coal-Pakp 74

Boone County Story.....p 78

Circuit Breaker Settings.....p 96

PRICE \$1

Cyclone Washers for Fine Coal . . p 118



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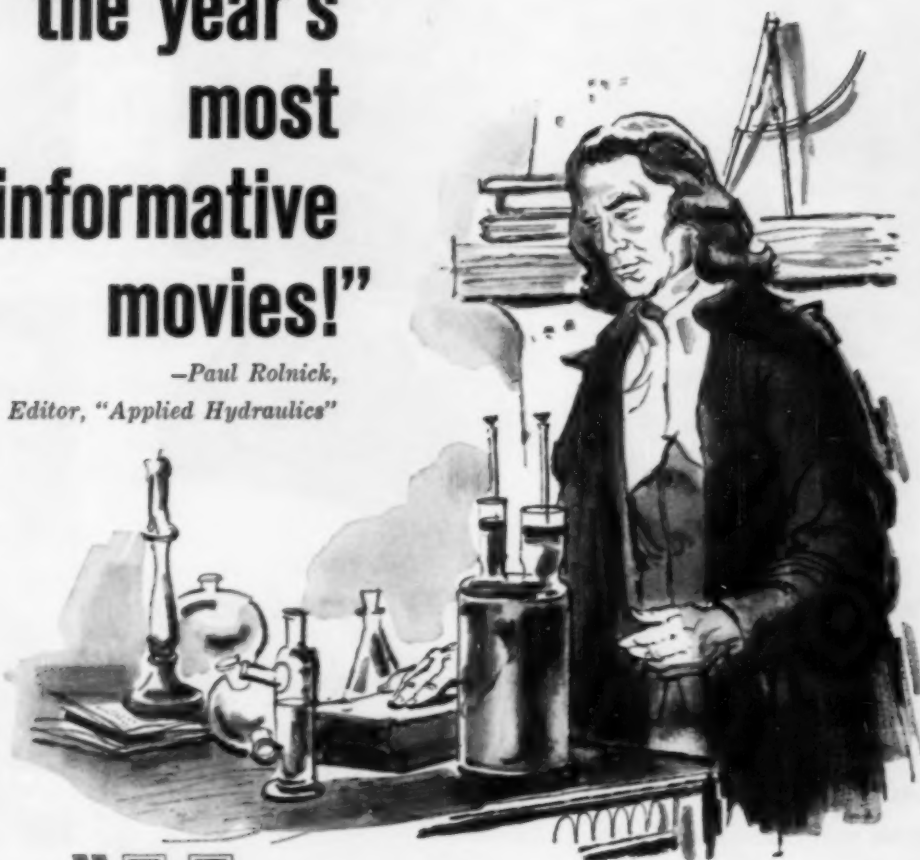
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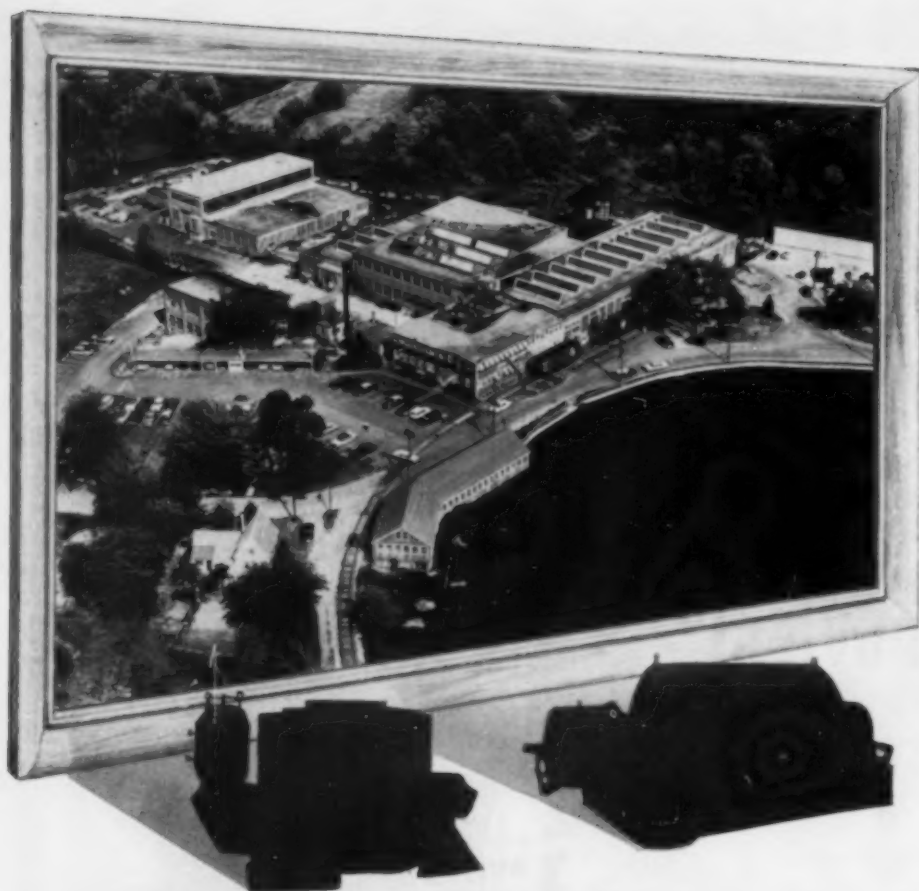
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This Month in DECEMBER 1958

COAL AGE

Features This Month:

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► Merchandising

Coal-Pak Ripe for Sales Growth p 74

W. A. Ruleigh Jr., Associate Editor, *Coal Age*

Initial merchandising progress with the Coal-Pak gives promise of growing nationwide use in small industrial plants, commercial buildings and institutions. Within the range of its capacities, the industry's new completely automatic packaged steam- and hot-water generator offers all the functional advantages of competitive packaged boilers, plus the benefits of savings from coal use. A critical need for maximum success: The massive effect of aggressive promotion by individual companies.

Featured—Cutaway sketch of Coal-Pak design; photo-panel: "The constantly improving spread of demonstration plants . . ."

► Deep Mining, Stripping

How Boone County Gets Results

In Mining and Preparation p 78

Daniel Jackson Jr., Assistant Editor, *Coal Age*

Deep mining at Boone County Coal Corp., Sharples, W. Va., is conducted with all-belt transportation in a

seam having an average pitch of 9% and local pitches of 25%. Careful planning of layout is necessary to limit recovery to about 70% to prevent seam rides. Seven seams are available for stripping, and this operation opens punch mining opportunities. Deep- and strip-mined coal are washed separately. Maintenance responsibilities are closely controlled, and all men are given planned safety instruction by their supervisors.

Idea Starter—Chart of Boone County's maintenance organization.

► Maintenance-Training

Training for More and Better Maintenance Men p 90

Using the facilities of the school and instructors primarily recruited from coal-company staffs, the Winding Gulf Operators Association, jointly with the Raleigh County Vocational School, is sponsoring both fundamental and advanced courses to increase both the supply and skills of maintenance men. The fundamentals course covers 3-hr sessions twice a week for 19 wk; the advanced course runs for 9 mo. Forty-eight men from 12 companies enrolled for the first session in fundamentals and 20 for the second. The first advanced course enrolled 21 men from companies belonging to the association.

Dividend—Detailed outlines of both the fundamentals and advanced courses.

► Electric Power

Overcurrent Settings for DC Circuit Breakers p 96

Donald J. Baker, Mining Representative, I-T-E Circuit Breaker Co., Inc.

Suggested overcurrent settings for DC feeder circuit breakers are tabulated to references as follows:

1. Distances from 1,000 to 10,000 ft in 500-ft intervals.
 2. No. 9 deep-section trolley wire in combination
- (Continued on p 7)

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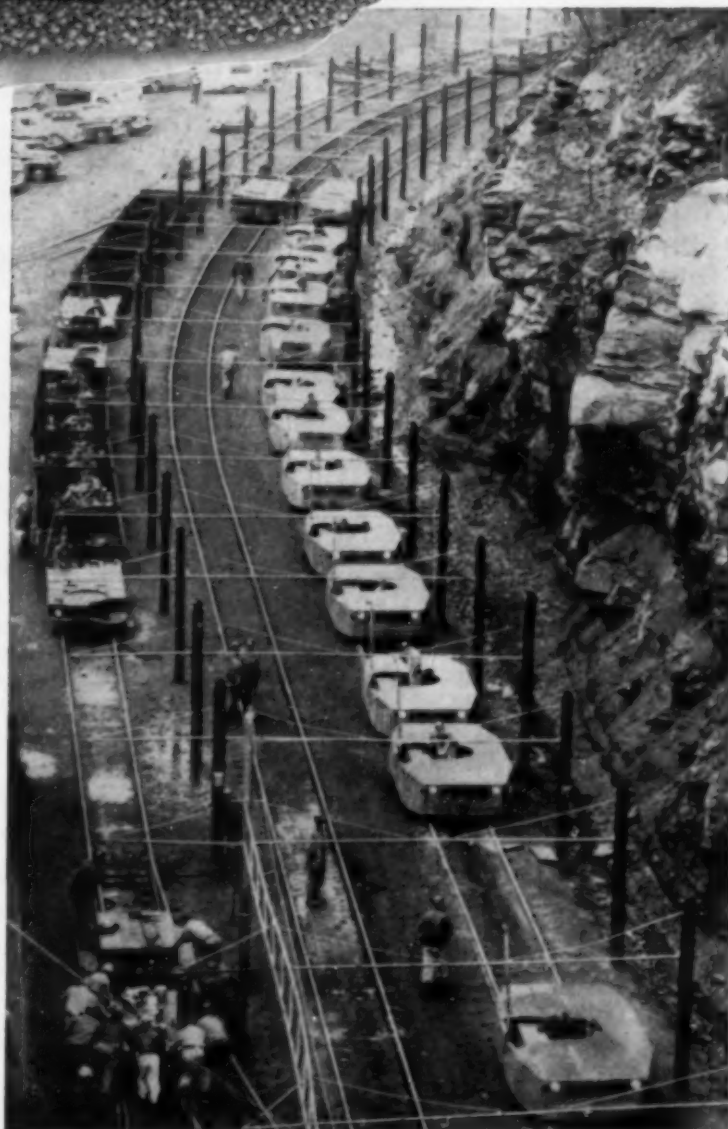
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This Month in Coal Age—Cont'd

with 500-, 1,000-, 1,500-, and 2,000-MCM copper feeders.

3. Common rail sizes from 40 to 120 lb per yd.

Total resistance values for these variables are shown in the table, and instructions for their applications in calculating breaker settings are included in the accompanying text.

Top Interest—Diagrams and explanations showing how to apply tabular information to underground needs.



► Stripping

Big Scrapers Key Flexibility

At 2,500 Tpd Strip Mine p 110

Ripper-equipped Caterpillar D-9 tractors precede wheeled tractors pulling 25-cu yd scrapers in removing up to 2,000 cu yd per hr of overburden at operations of Swisher Coal Co., Pomeroy, Ohio. The scrapers work to banks up to 60 ft in height. Scraper stripping provides flexibility of operation and offers the advantage of faster moves to new areas. Furthermore, this method leaves the spoil area in a condition requiring a minimum of leveling and backfilling. Ammonium nitrate is used as a blasting agent in harder overburden.

Highlight—How Ura Swisher, company president, uses a company airplane to speed maintenance.

► Preparation

Cyclone Washers For Fine Coal p 118

H. F. Yancey, Chief, Div. of Solid Fuels Technology, U. S. Bureau of Mines, Region I, Seattle, Wash.

Europe now uses cyclones with a capacity of 1,600 tph to clean fine coal— $\frac{1}{2}$ -in top down to 48-mesh bottom sizes. The medium is magnetite. The feed is raw coal or middlings and a two-product separation often is the goal. Cyclones may operate at different densities to produce a primary product and a secondary coal for fuel or other disposal. Separation is sharp, recovery is good and final ash is low in all size fractions. Mag-

(Continued on p 9)

This Month in **COAL**

400 MILLION PLUS—The plus, in the case of 1958 bituminous output, bids fair to be only a minimum number of millions of tons—quite likely not over 5, bringing the total for the year up to 405 million or thereabouts. Reason? Failure of the recovery to reflect back into coal production with continued low exports a complicating factor.

When a consistent weekly rate of $9\frac{1}{4}$ to 10 million tons will be reached still was a question as December opened up. Indications are that things still will be slow when 1959 comes in—and perhaps for some time afterward.

Anthracite has fared quite a bit better than bituminous, with indications that it could wind up with over 22 million for 1958.

1959 IN CONGRESS—The Democratic landslide in November is expected to have a significant effect on the approach of the next Congress to a number of problems. Attitude on those in which coal is involved probably will be as follows:

1. Much more steam in the drive to put the government in the nuclear-power business—with possibly a measurable degree of success.

2. A greater disposition to spread money abroad and, paralleling this, a disposition to reduce or eliminate curbs on imports into the U. S., including oil and natural gas.

3. A harder fight to reduce or eliminate restrictions on unions and union officials.

4. A tougher attitude toward business from the tax and other standpoints.

5. A higher budget and a higher debt ceiling.

The major restraint on the hotheads will be conservative Democrats, helped by the Republican minority.

FEATHERBEDDING AHEAD?—One swallow does not make a summer, but a few attempts now being made to featherbed certain mining operations are being regarded as possibly opening the door to a major operation. At one property, as an example, a drive is underway to force the employment of loader helpers on the ground that a rate is included in the national agreement and consequently helpers must be hired. A foreboding sidelight is the fact that the attempt is receiving tacit if not open encouragement from union headquarters.

AND HIGHER WAGES?—If 1958 ends without an agreement on a wage increase, expect it in 1959—probably early. Amount? Some of the betting is not over \$1. But it could be as much as \$2 in the recently adopted two-stage package. Chances for other major concessions? Somewhat slim, though still possibilities.

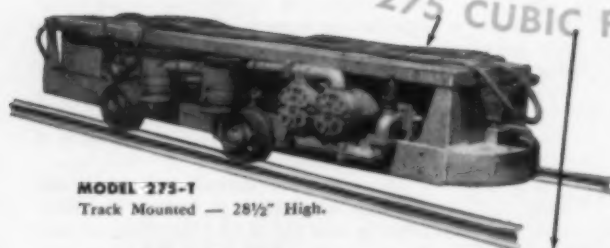
GAS COMPETITION—With $1\frac{1}{2}$ c per M per 100 mi as the rule-of-thumb cost of moving gas in new pipelines (1c in old lines), recent developments in the natural-gas field, including Canadian discoveries and the Borden Commission report, have focussed additional attention on delivered coal prices in the United States. Anywhere they are over \$9 to \$10 per ton, gas could get in. Expectation? Tougher gas competition in the relatively near future—for a time at least.

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netite consumption ranges from 1 to 3 lb per ton of feed.

For the U. S.—High efficiency should make the cyclone a valuable new tool. Early use is expected for fine-coal cleaning.

► Fall Meetings Roundup p 122

Reports of proceedings at industry meetings this Fall, written by Coal Age editors in attendance at the meetings, include National Safety Council (p 122), Illinois Mining Institute (p 126), West Virginia Coal Mining Institute—Central Appalachian Section, AIME (p 130) and Kentucky Mining Institute (p 136).

► Coal Age Annual Index p 168

Index to volume 63 (January through December, 1958) contains alphabetical listing of 1958 editorials, articles, news features and departments under major topics of industry interest.

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This Month in Mining Practice

VENTILATION FOR MINERS—The gas problem with continuous miners starts with steady-rate liberations of up to 240 cfm or more. Boring-type machines present the knottiest problems, including the need for intaking on the narrow side of line brattice to achieve the necessary velocity in the face zone. But some have found that even the best in line brattice is not good enough, with the result that the tubing blower, outlawed for many years in new mines, may well stage a major comeback.

As part of the program of improving conditions at the face, dust collectors, which also help in ventilation, are receiving major attention. New is a unit mounted on the head end of a boring unit. Good results are expected.

CYCLONE WASHING—Though no cyclones are so far used in that fashion in the United States, they are finding growing application in western Europe for heavy-medium cleaning of fine coal. High efficiency and high capacity per unit of floor space are among the major advantages (see feature elsewhere in this issue).

Forecast—Early initial use and quick expansion thereafter in the U. S.

MORE RUBBER—Tires account for a good part of the initial cost of big trip-hauling units. They also account for a good share of the operating cost. Consequently ways and means of lengthening life are of continuing interest. One suggestion is more rubber on the tread, since at least one stripper has found that the carcass is still good, as a rule, when the tread is gone. Obviously, if carcass damage is the big factor, tread thickness becomes less important. Otherwise, it is worth some thought.

Incidentally, the size of units being contemplated has jumped to 125 tons, which brings in, among other questions, those of turning the unit in the pit and transmissions able to stand the gaff. Answers undoubtedly will be found. Meanwhile, the four-wheel-drive tractor is helping some operators where sharp grades are frequent.

CLEAR SPLICES—The forms of plastic from which trailing cables may be made include a clear one permitting complete visibility of the conductors. So far, according to reports from the field, men tend to treat such cables with much-greater care. Clear vinyl plastic also is used for repairing colored plastic and also rubber-neoprene cables. Advantage? Ability to check the internal condition of a splice at any time by shining a light through it.

DISTANCE CUTTER—Shuttle cars behind continuous miners may be desirable for any of several reasons. Distance of haul is, however, a critical factor, especially with the older, slower models. Consequently, a distance cutter is worth a moderate investment. One such unit developed by a Middle Western coal company is a rubber-tired belt 200 ft long. This "Centipede," as it is called, cuts the round-trip haul 400 ft and is expected to permit the same or greater tonnage with only two cars instead of three.

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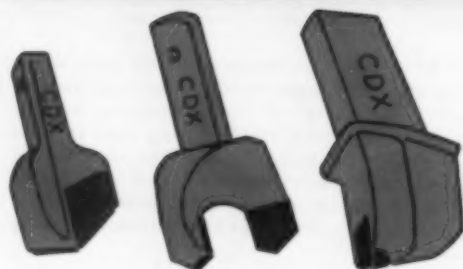
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The Coal Commentator

New Wedge

Barring an unforeseen contingency, the January issue of *Coal Age* will include a feature reviewing the present status and future prospects of electric home heating. Both, incidentally, are good.

One drawback that might be somewhat more than slight is the possible effect on the market for household coal, which still is a high-profit one. But the big effect probably will be on oil and gas as it becomes more and more apparent that coal will get back into the home for heating by wire in real volume.

Quite a few electric utilities are betting that way and backing up their bets with reductions of up to one-quarter and one-third in rates per kilowatt-hour. Home heating electrically is in the snowballing stage now, and the pace will get faster and faster.

How Tough?

Recent reports from Great Britain indicate an approach to certain safety and disciplinary fundamentals much tougher than anything ever considered in the U. S. The National Union of Mineworkers, for example, was actually considering recommending that carrying smoking materials and matches into closed-light mines be punished by immediate dismissal and blacklisting for life.

The preceding, as noted, is in the field of safety. In employee relations the National Coal Board has sued seven miners for refusal to obey the orders of their supervisor, resulting in damages from loss of production.

Whether the British will continue to carry through in insisting that individuals assume the necessary personal responsibility for safety and production is still a question. But discipline is a necessity, here as well as in Great Britain, and it should be backed by the necessary degree of toughness if progress is to be made.

Results-Getter

The selection of W. E. McClain, senior maintenance engineer, Frick Dist., U. S. Steel Corp., as "Maintenance Man of the Year" by the Mining Electro-Mechanical Maintenance Association is one more evidence of the growing importance of maintenance in the coal pictures of today and tomorrow.

Congratulations are of course in order for this signal honor, which has been well-earned. At the same time, it is well to re-emphasize the need not only for better maintenance methods and facilities, and especially for more qualified men.

The methods of developing such men in the necessary number include association-sponsored regional programs. One is the Winding Gulf, reviewed in a feature elsewhere in this December issue. It is getting results.

Now Chloride

Reports on mining developments from abroad, especially from Russia and Red China, continue to emphasize the growth of hydraulic mining, hoisting and overland transport. And there are other things, including a new "ram plough" for steep pitches. European operators continue to find the plow a most-useful tool under their conditions, including coal down to 18 in or less in thickness.

To get back to hydraulic mining and transport, Red China is reported to be developing a standard hoist for mines producing more than 240,000 tons a year. And in Russia, the problem of hydraulic transport is being tackled by, among other things, using a calcium chloride solution with a gravity of about 1.35. Less settling is a major advantage of chloride use.

Air transport has not yet made the reports coming to your commentator, but it probably can be expected. Meanwhile, the U. S. is out quite early, if not first, with this idea.

Well-Earned

Diverse but equally important in industry progress is a thumbnail summing up of the careers of two men who retired Nov. 1 after over 60 yr of service each.

One was Walter Thurmond, for many years secretary of the Southern Coal Producers' Association and a long-time worker for coal in both the South and nationally.

The second was R. M. Lambie, for many years head of the West Virginia Dept. of Mines and recently a member of the M-S-A staff with headquarters at Charleston.

All who know them will find it easy to mark their contributions and to wish them long life and happiness in well-earned retirement.

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These Reliance Traction Motors withstand punishing overloads in starting loaded trains. Operating conditions are damp and gritty. In spite of this damaging environment, Reliance D-c. Motors have given years of reliable mining service.

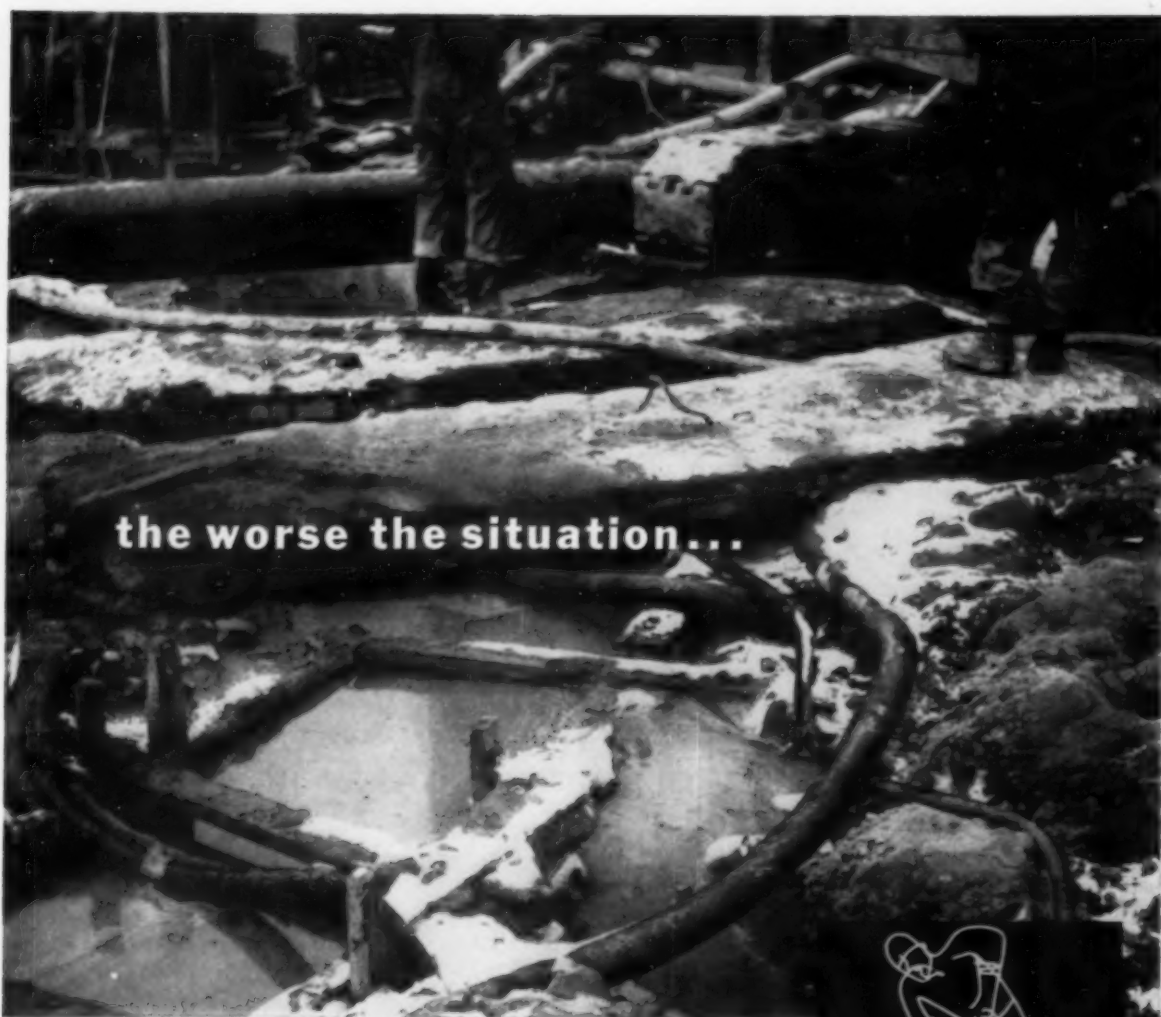
This is typical of the performance you will get from all Reliance products. Contact your local Reliance Representative today for your a-c. motor, d-c. motor and gearmotor needs.

C-1004



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ENGINEERING CO.**

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TIREX cords and cables give longest service when not subjected to severe abuse. But when required, TIREX can take it. In snow and mud, under water and under pressure, TIREX cords and cables remain flexible, smooth, light and easy to handle, thanks to their original cured-in-lead construction. They won't snag or tear, and their fortified and tempered neoprene armor gives balanced resistance to abrasion, water, acids, oils, sunlight and flame.

Millions of feet of TIREX are on the job everywhere — transmitting power for mobile mining equipment, construction machinery and portable tools.

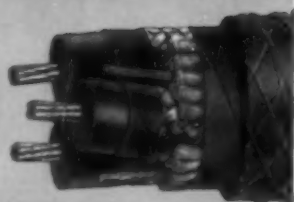
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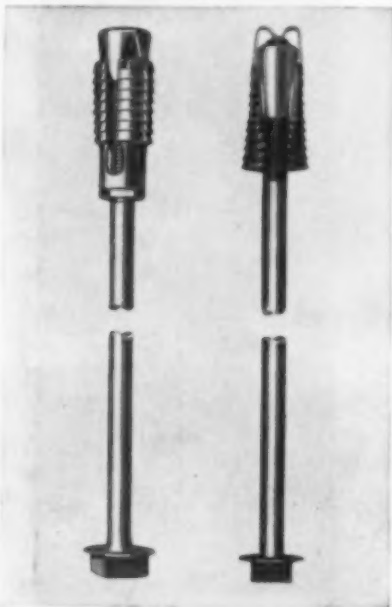


CERTIFIED STEEL ASSURES SUPERIOR STRENGTH

In Every Republic Roof Bolt Sold



MATERIAL CONTROL CERTIFICATE FURNISHED BY REPUBLIC with every roof bolt shipment gives specific physical properties of the steel used in manufacture. Guesswork and assumptions about performance are eliminated. Illustration below shows Republic's newest and most versatile expansion shell designs. RS-1, at left, is designed for relatively soft formations and can be shipped assembled with the bolt or in separate components. RE-3, at right, is well suited to harder formations.



MINE ROOF BOLT MATERIAL CONTROL CERTIFICATE			
<i>Republic Steel Corporation hereby certifies that the mine roof bolts included in mill order number _____ were made from the following steel:</i>			
HEAT NO.	YIELD POINT (PSI)	YIELD POINT (TENSILES)	BREAK POINT (TENSILES)
<i>The above figures are correct as contained in the official records of the Corporation.</i>			
BY _____ CHIEF METALLURGIST, BOLT AND NUT DIVISION			
REPUBLIC STEEL CORPORATION General Offices • Cleveland 1, Ohio			

No matter what roof-bolting problems you face, in high or low roof areas . . . hard or soft formations, Republic Roof Bolts offer a combination of advantages unmatched by any other manufacturer to assure maximum top-holding reliability. Not the least of these advantages is Republic's exclusive Material Control Program, plus the most complete selection of roof bolts on the market.

Because Republic is an integrated steel producer, the Material Control Program actually extends from mining and blending of raw ores to finished roof bolt production. Key element in this procedure is a series of physical tests which every heat of steel used in roof bolt manufacture must pass. Test results entered on Material Control Certificates, accompany all shipments as direct evidence that Republic Roof Bolts meet or exceed the physical properties standards approved by the American Mining Congress and American Standards Association.

In addition to laboratory-certified steel, all Republic Roof Bolt Assemblies are backed by the findings of extensive field performance tests conducted in Republic's own mines. As a result of these studies, only Republic offers proved assemblies in all four major classifications. Moreover, this experience enables Republic impartially to recommend the type or types best suited to conditions in your mine, along with suggested methods of placement and spacing.

For complete information on certified-strength Republic Roof Bolts, contact your Republic representative or mail coupon.

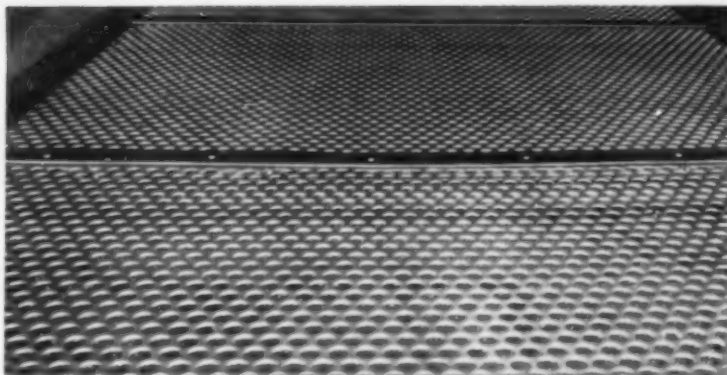


MANY SUPERIOR FEATURES OF REPUBLIC'S NEW TRUSCON STEEL BUILDINGS contribute to their economical performance in mining applications. All parts are delivered in a complete package, including roofing, siding, windows, doors, and hardware, ready for fast, easy erection. Available in 32-, 36-, 40-, 44-, and 48-foot widths, 12- and 14-foot heights, and any required lengths, these Truscon "Budget Buildings" are ideal for personnel, equipment, or material shelter. Roofing and siding are galvanized to eliminate painting. Buildings can be dismantled and stored or re-erected to meet changing needs. Send coupon for details.



SUPERIOR STRENGTH PLUS CORROSION-RESISTANCE are two of the many features of Republic High Strength Steel which make it ideal for a wide variety of mine industry applications. In mine car and hopper car use, for example, these factors contribute to greatly reduced maintenance. Republic High Strength Steel also provides good impact and abrasion-resistance. It will pay you to evaluate all of these advantages in terms of your equipment performance specifications. For more information, mail coupon.

SUPERIOR PERFORMANCE OF REPUBLIC ENDURO® STAINLESS STEEL used for this cleaning plant shaker screen has drastically reduced replacement expense. Reason is ENDURO'S excellent resistance to abrasion and corrosion. Other characteristics of ENDURO which pay service dividends in mine equipment applications include its good strength-to-weight ratio, easy cleanability, and high impact strength. In addition, ENDURO is readily formed and welded, simplifying both manufacturing and maintenance operations. Mail coupon for data.



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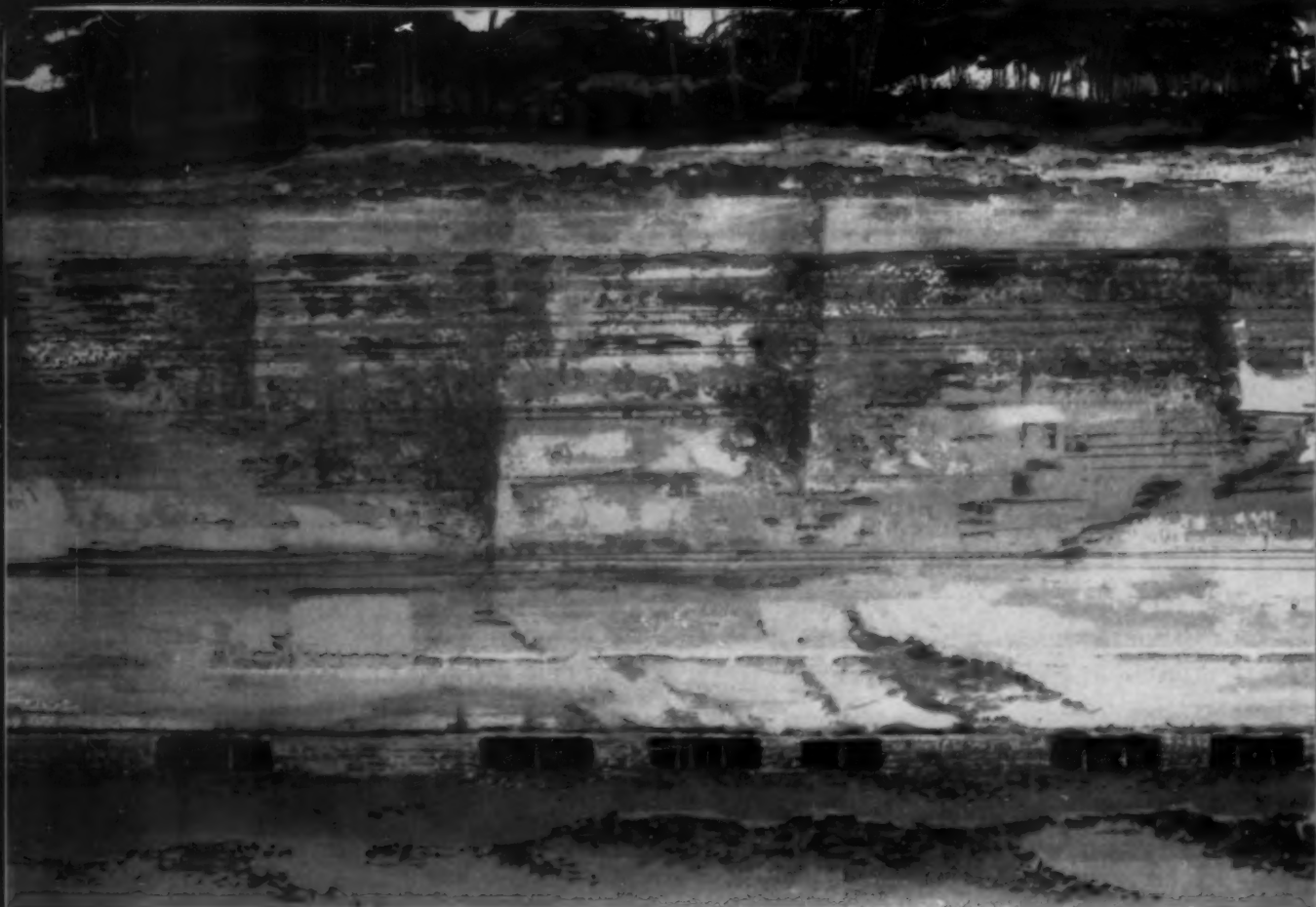
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☐ High Strength Steel ☐ ENDURO Stainless Steel

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Company _____

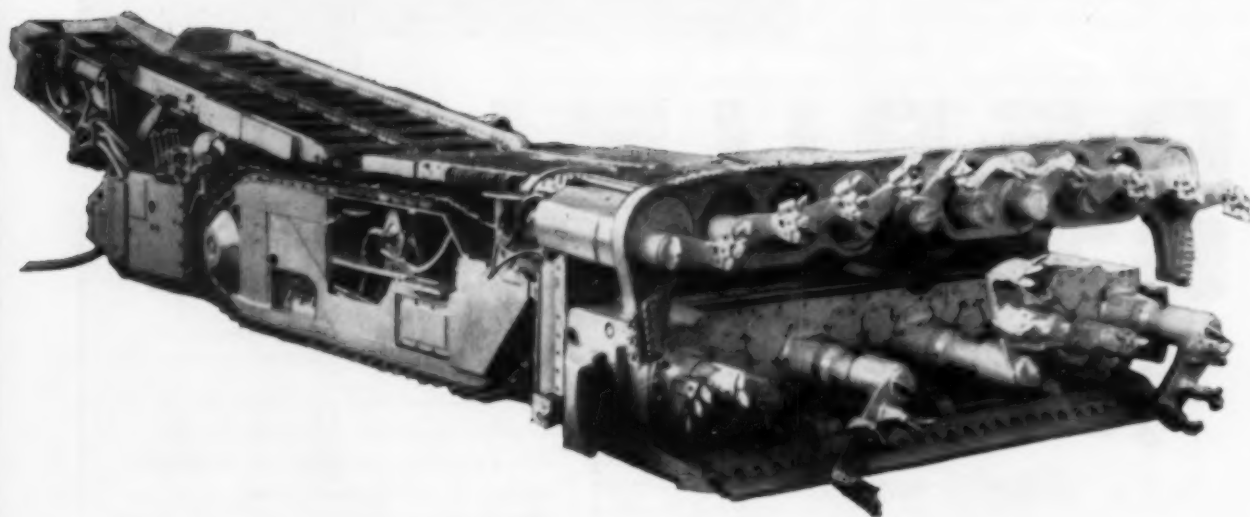
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average—535 tons per 8-hour shift

REMARKABLE PRODUCTION is reported by users of the Jeffrey Colmol...in so many types of coal mining operations. In a new highwall mining operation, for instance—Colmol delivers an average of 535 tons per 8-hour shift. Ten minutes after cutters attack the face, the Colmol has dug its way out of sight.

The Jeffrey Colmol requires minimum maneuvering and manipulation of controls...handles easily on its long, wide crawlers...turns in its own length.

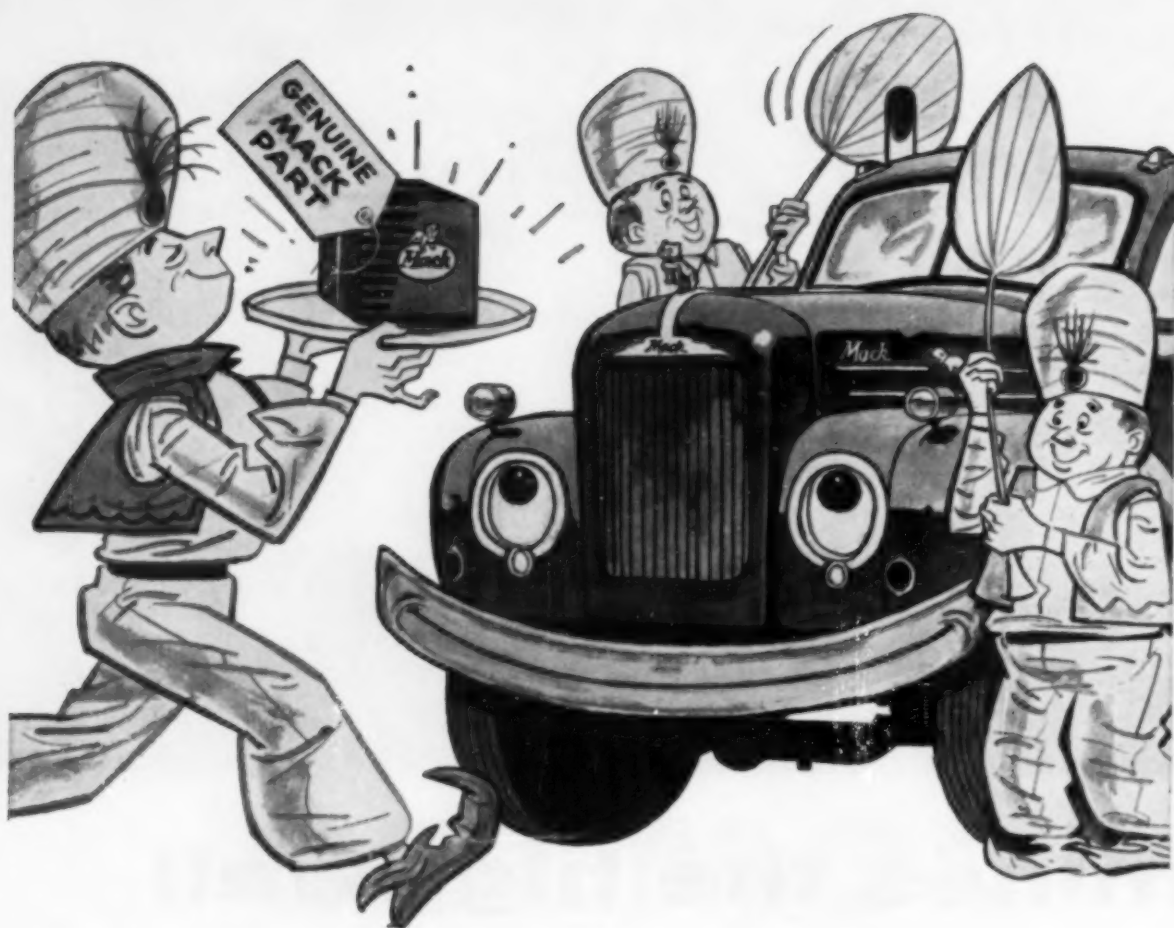
It faces up to the most severe mining conditions, operates with little noise or vibration. Coal is *broken* from the face...*not ripped or ground off*. You get better overall consist, greater speed and efficiency with a Colmol.

In seams as low as 28"...or as high as 96" Jeffrey Colmols step up your production rate, cut operating costs. Write for complete details. The Jeffrey Manufacturing Company, 912 North Fourth Street, Columbus 16, Ohio.



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For all its rugged stamina, your Mack is a precision machine. You can dull the edge of its remarkable efficiency with replacement parts that aren't engineered to Mack's matchless standards. Macks deserve the best—Genuine Mack Parts.

So insist on the premium performance you'll get with Mack Parts—designed or tested by Mack engineers and guaranteed to perform like the original units. Even better, in some cases, for Mack components are continually improved as new methods and materials are developed.

You operate the world's best trucks when you own Macks. Keep 'em that way with the world's best parts—*made by Mack . . . made for Macks.* Mack Trucks, Inc., Plainfield, New Jersey. In Canada: Mack Trucks of Canada, Ltd.

MACK
first name for
TRUCKS

EVERYWHERE A MACK GOES . . . THERE ARE MACK PARTS . . . AND MACK SERVICE



Austin AP-10 end mill type (top) and AP-10D plug type cutter bits.

Austin Cutter Bits reduce mining costs

New AP-10 end mill and AP-10D plug type cutter bits are precision manufactured by Austin Powder to penetrate faster . . . last longer . . . reduce mining costs.

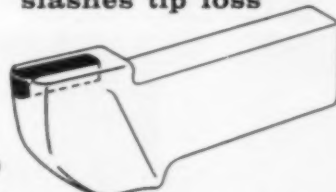
Carbide inserts are brazed in special alloy steel shanks to assure strongest possible support. As a result, tool failure, due to tip loss, is virtually eliminated even under most severe cutting conditions. This assures more production time, less time lost in bit changes.

Your Austin representative will gladly show you how these and other features of AP bits can improve your operations. Call him today! AA-5826



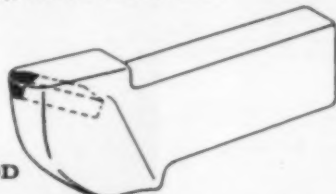
AUSTIN
POWDER COMPANY
CLEVELAND 13, OHIO

Maximum carbide support slashes tip loss



AP-10

Three sides and extreme end of carbide insert in Austin end mill type bit are brazed to shank.



AP-10D

Entire surface of carbide insert in Austin plug type bit with exception of cutting edge is brazed to shank.

Bellaire, O. Brookville, Pa. Chapmanville, W. Va. Charleston, W. Va. Coaldale, W. Va. Evansville, Ind. Grundy, Va.
Hazard, Ky. Madisonville, Ky. Masontown, W. Va. Matewan, W. Va. Mt. Hope, W. Va. Waynesburg, Pa.

"We increased our cable life



Supervisor checks the cable where it makes an "S" curve. Thin tubing overhead is for mine's pneumatic blasting system.

Shuttle car unloads itself with built-in conveyor. Notice twisted Tiger Brand cable above man's head.



with TIGER BRAND,"

—says *Master Mechanic of a large Pennsylvania mine*

THE mine shown here is clean and modern, but it has just one purpose: to produce coal at a profit under safe working conditions. The mine has about 30 miles of trackway, and produces about 4,500 tons daily. About a dozen shuttle cars are in constant use, between rail heads and working faces that are frequently 100 to 200 yards apart.

The shuttle car electrical cable takes a terrific beating. The car often takes a circuitous route, and the cable is pulled tight around the corners of standing coal while it is reeled and unreel without stop for the entire shift.

The Tiger Brand cable has outlasted the previous cable by a considerable margin. This is partly due to our "Bridgewall" construction, which actually puts a sheath of live jacket rubber around each conductor. Even when the cable is kinked or smashed, the conductors are protected by a thick wall of the toughest jacketing compound available in the industry.

The other factor that contributes to long trouble-free life is the dynamically balanced rope lay conductors. Concentric stranded wires of the ideal size—as opposed to loosely bunched groups of fine wires—are carefully prestressed to give balanced performance and freedom from unequal elongation between conductors.

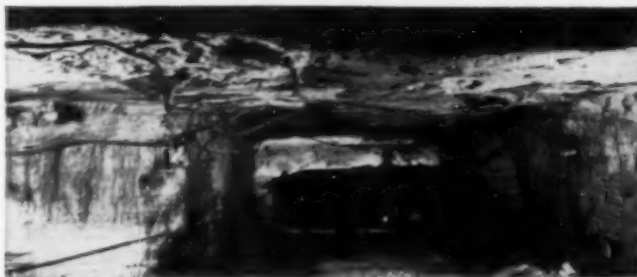
Tiger Brand cable isn't cheap, but it's a good investment for any company that needs long, hard service. See your American Steel & Wire salesman. Or write direct to American Steel & Wire, 614 Superior Ave., N.W., Cleveland 13, Ohio.

USS and Tiger Brand are registered trademarks



Workman ties up cable. Spring-loaded strain reliefs are used when possible. Tape on cable prevents it from slipping through the relief.

Shuttle car makes return trip. Cable feed center is out of picture 100 yards or so to the left, near the rail head.



Tiger Brand Electrical Wire & Cable

Asbestos Wire and Cable • Mold Cured Portable Cord • Shovel & Dredge Cable • Paper & Lead Cable • Varnished Cambric Cable
Interlocked Armor Cable • Special Purpose Wire & Cable • Aerial, Underground and Submarine Cable

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United States Steel

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another

DORRCO FLUOSOLIDS COAL DRYING SYSTEM

*Now on stream at
INLAND STEEL...*

Another large Dorrco FluoSolids coal drying system was recently put in operation at the Inland Steel Company's new coal drying plant at Price, Kentucky.

Currently, the system is removing 22.0 tons of water per hour from a wet feed of 180 tons per hour of $\frac{3}{4}$ " x 0 metallurgical coal.

These statistics, however, show only a partial story, for FluoSolids coal drying, when compared with conventional thermal drying techniques, is proving commercially to provide higher efficiency, higher capacity, closer operating control with lower maintenance.

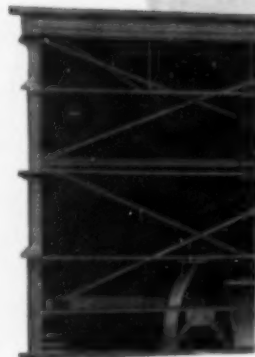
Operating data substantiating these facts are available. For the complete Dorrco FluoSolids coal drying story . . . and more significantly how application of the system can benefit your plant operation, write to Dorr-Oliver Incorporated, Stamford, Connecticut.

What is the FluoSolids System?

A VALUABLE TOOL FOR DRYING, SIZING AND HEAT TREATMENT

When particles are suspended in an upwardly moving stream of gas, the entire dense mass behaves much like a liquid and is said to be fluidized. Applied to coal drying by the Dorrco FluoSolids system, fluidization results in a new and better drying technique, in which the efficient mixing action of the fluidized bed instantaneously transfers the heat from preheated air to the wet coal. A combination of reactor, blower, cyclones and other auxiliary equipment forms a complete processing system, adaptable to a wide range of drying, sizing, roasting and heat treatment applications.

HELP FOR YOUR PROBLEM: The science of fluidized coal drying was pioneered by Dorr-Oliver. The benefits of this vast experience can be profitably applied in your plant. If you will send us a brief outline of your problem, we will be glad to have an engineer call at your plant for further discussion.





This general view of the Inland Steel installation clearly illustrates compactness of high tonnage FluoSolids coal drying system. The complete plant, engineered and erected by Dorr-Oliver on a turnkey basis, occupies a space 90' by 35' and is 60' high.



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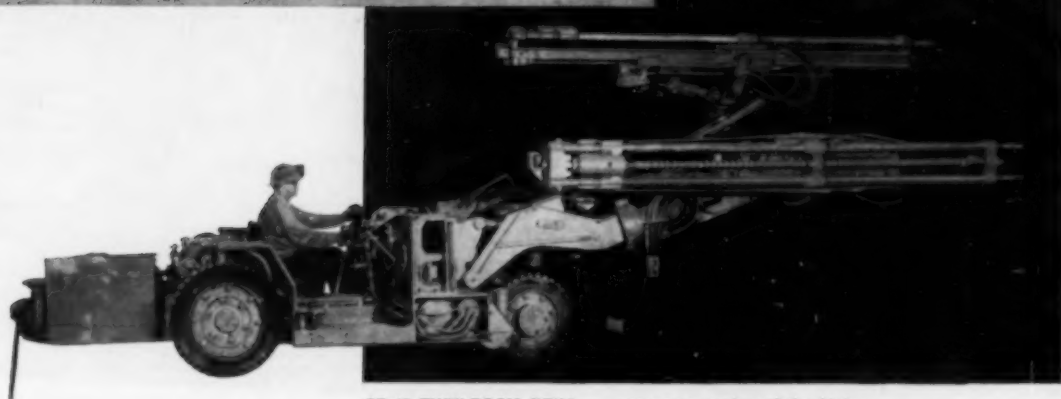
A NEW HIGH PRODUCTION TEAM FOR HIGH SEAM COAL

Maximum production from high seam mines requires machines designed especially for high seams. That's why Joy engineered the "15 Series."

These machines were designed to work as a team in coal 5½ feet and higher. The twin boom CD-43 drills 10 foot holes continuously with just one operator. The powerful 15-RU reaches up to 10 feet to top cut the highest of roofs. The 15-BU loads 15 tons per minute to keep up with the cutter and drill, and the 15-SC shuttle car hauls big loads fast enough to keep pace with the rest of the team. Each unit was designed with the others in mind as part of a team. To really lower cost per ton and move the tonnages expected of a high seam operation, check into Joy's new "15 Series."



15-RU CUTTER . . . It bottom cuts, top cuts, shear cuts or anything in between. For top cutting at 8½, 9½, or 10 ft.



CD-43 TWIN-BOOM DRILL . . . one-man version of the high-production, two-man CD-42 drill. Long steels eliminate auger changes. Capacity 9 to 12 fpm, each drill.

JOY

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All Joy coal mining equipment, including the "15 Series," is available with AC or DC.

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JOY

"15 SERIES"

CUT 15-RU

DRILL CD-43

LOAD 15-BU

HAUL 15-SC



15-SC SHUTTLE CAR . . . 57" high . . . hauls 15 tons in one load for easier, faster loading; fewer trips; cheaper haulage.

15-BU LOADER . . . loads 15 tons per minute. Model shown is 56" high . . . lower model, 43" high, works 34" coal.

News Roundup

Washington Sets Stage for Stiffer Competition FPC Opens Door to Canadian Gas Imports

In the wake of the Borden Commission report which virtually asked the Canadian government to okay gas exports to the U. S. (*Coal Age*, November, 1958, p 25), the Federal Power Commission virtually opened the door Oct. 31 to imports by U. S. gas pipeline companies.

Denied "with profound regret" were competitive proposals by U. S. companies to import Canadian gas for midwestern markets. Along with this denial, however, FPC invited new applications, indicated how these applications should be revised to win approval, and strongly implied that coal interests sought preferential treatment where expansion of natural gas service was justified by public convenience and necessity. FPC said:

"We think that, assuming the Canadian authorities eventually permit its export, Canadian gas should and inevitably will be made available to this and probably other areas of this country, to the mutual benefit of both U. S. purchasers and Canadian sellers. . . . Even though we cannot authorize importation of Canadian gas at this time, we are confident that in due course, when more satisfactory commitments are made and supplies more adequately shown, we will find it possible to authorize its importation."

Initial proposals denied were made by Midwestern Gas Transportation Co. and its parent, Tennessee Gas Transmission Co., Houston, Tex.; Northern Natural Gas Co., Omaha, Neb.; and Michigan-Wisconsin Pipeline Co. FPC based denials on failure of applicants to meet statutory requirements calling for proof of public convenience and necessity.

These companies are losing no time in drafting new applications adapted to required adjustment. Shortly after FPC handed down its decision, the *Wall St. Journal* reported that top officials of Midwestern Natural Gas and Northern Natural Gas "have been meeting in the hope of drawing up a joint proposal to present to the Federal Power Commission. . . . Presumably a compromise between two competitors would mean Midwestern would apply for permission to bring Canadian gas into the area while, at the same time, it would drop,

in favor of Northern Natural, communities it originally proposed to serve."

In seeking to block Midwestern's proposal, NCA and other coal "interveners" have argued that it is contrary to the public interest and national defense. They say it would displace sales of coal in excess of 2,000,000 tons annually, seriously damage the upper-lake coal-dock industry, and make the economy of the region largely dependent on natural gas as a single source of fuel supply.

"In our judgment, the evidence does not support these contentions," FPC states. "We think that the coal interveners, to support their predictions as to the effects of the consumption of coal in the affected area and on their

own business interests, rely too heavily on incomplete data and overlook other facts which point to more favorable conditions than they envisage. . . . The evidence shows an expanding market for coal and fuels generally which should absorb additional volumes of natural gas and enlarged markets for coal.

"The facts do not support carving out of the economy a preserve for one segment of one industry and insulating it from the competition which technological progress brings. The public convenience and necessity require that natural gas service be extended and enlarged in this section of the country. We cannot find that conditions designed not with reference and regard to this central fact but framed primarily to protect and preserve a competing industry are required by the public convenience and necessity. . . ."

Democratic Landslide Toughens Battle

How will the Democratic landslide in Congress affect coal's legislative program? The answer to such a question is never black and white. But this much is quite clear: Those industries seeking legislative redress within the perimeters of traditional Democratic policy will gain most; those, like coal, whose problems generally fall outside the Democratic camp stand to suffer some retrenchment of their cause.

A roundup of expert political opinion, assessed against this major premise, thus shows the outlook for major areas of coal interest shaping up as follows:

Prospects for mandatory curbs on residual oil imports are not encouraging.

Democrats, traditionally bound to liberalizing import policy, are not likely to seek reversal of the present voluntary program based jointly on refinery activity along with past import experience.

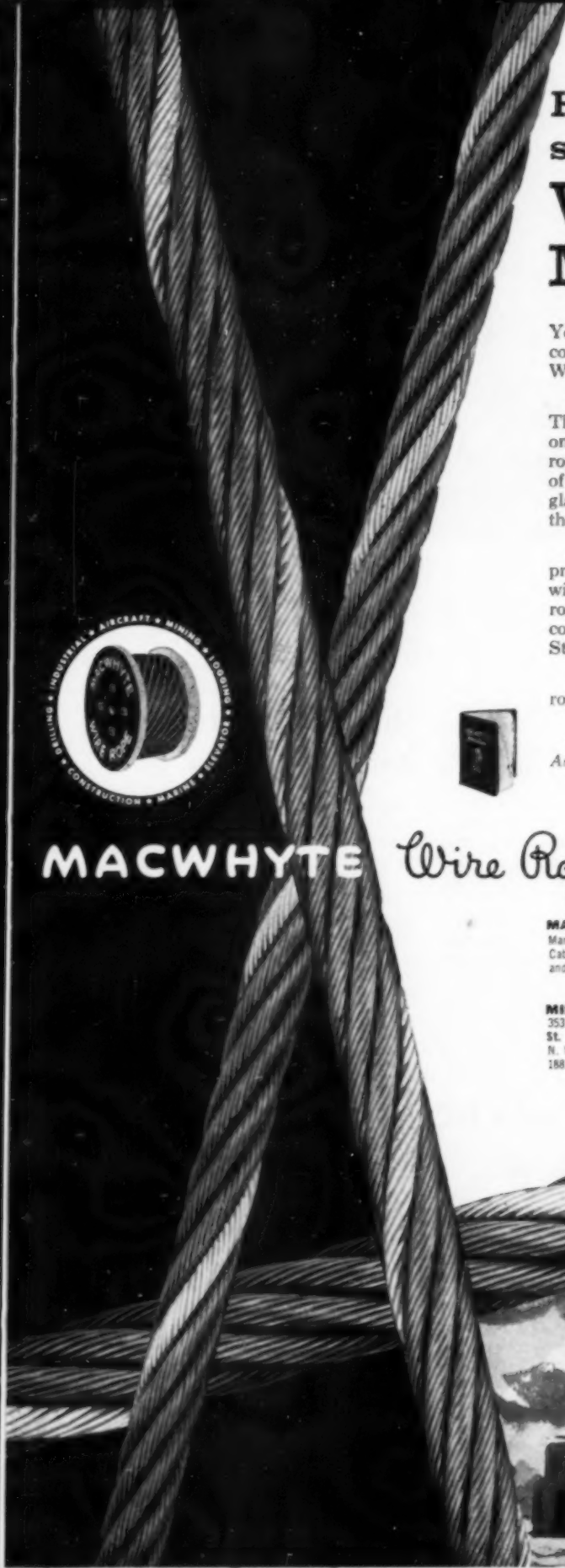
After two defeats in two successive years, most Washington observers agree the natural gas bill—giving producers relief from federal price control—will not be revived for a third time. Although this benefits coal, a possibly more ominous problem is in the making. As noted elsewhere on this page, the FPC has already virtually given the nod on imports from Canada and any legislative redress by a Democratic Congress is improbable.

Public power will probably get a boost with expected passage of the Kerr bill (S. 1869). This grants TVA authority to finance future expansion by issuing up to \$750 million in revenue bonds. The Senate passed the bill in August, but it got pigeonholed by a House Rules Committee at adjournment time.

Increased Federal support of atomic power development is a strong possibility. Democrats have consistently advocated what opponents to nuclear expansion have termed a "crash program." And, even during the last session of Congress, with party control less

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How to get longer service life with **Whyte Strand Mining Ropes**

You can lengthen the service life — and lower the yearly cost—of your wire ropes by using the *correct* Whyte Strand Wire Rope for each application.


What do we mean by correct? Well — all wire rope isn't alike. The demands of dragline service are different from those on haulage ways or shaft hoisting. And there's a Whyte Strand rope specially designed to withstand the particular abuses of *each* kind of mining service. What's more, we'll be more than glad to work with you in finding which of Macwhyte's thousand-and-one ropes is the *best* for your kind of job.

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News Roundup (Continued)

firmly established, the Democrats pushed through \$386 million in reactor-construction and study funds—twice the amount called for by the administration.

No general legislation on tax relief is in sight, mainly because of the currently high Federal deficit. But, if another recession should set the stage for a tax bill, McGraw-Hill's Washington Bureau warns:

"The first call would go to the low individual income brackets. Business would get little or no consideration, either on a reduction in the corporate rate or liberalization of depreciation, which the GOP considers essential to economic growth."

Aid for depressed areas will be pushed and could benefit some hard-hit coal mining regions in, for example, Pennsylvania, West Virginia and Kentucky. The tendency, however, will be to favor industrial northeast areas, such as Detroit, where union leadership contributed heavily to the landslide.

Disasters Claim 108 Miners' Lives

Within less than a week, a major bump in Canada and two explosions in the United States resulted in the deaths of 109 miners in late October.

Seventy-five men were killed in a massive bump in the No. 2 colliery of the Cumberland Ry. & Coal Co., Ltd., Springhill, Nova Scotia, Oct. 23. Twelve men were found alive by recovery workers Oct. 30 and seven more the following day.

An explosion at the No. 34 mine of the Pocahontas Fuel Co. Div., Consolidation Coal Co., Bishop, Va., killed 20

miners and two foremen — Calvin Blankenship and Neal Rutherford—Oct. 27.

Another explosion the following day blasted the Burton mine of Oglebay, Norton & Co., near Summerville, W. Va. In addition to ten miners, four officials lost their lives. They were: Harry Gates, superintendent; Edward Stephenson, assistant superintendent; and Harry Fletcher and Pete Weese, foremen.

Soft Coal Talks At a Standstill

Demand that industry promise not to handle non-union mined coal blocks discussion.

John L. Lewis has unofficially set January 1 as the deadline for the soft-coal contract and Edward G. Fox, president of the Bituminous Coal Operators Association, has agreed to discuss higher wages and other contract improvements.

But before Mr. Lewis will sit down to talk about a new contract, he insists that the industry vow not to handle coal mined by workers not in the United Mine Workers Union. The soft-coal operators have declared that there is no way of writing such a ban into the contract without making themselves liable to prosecution under federal anti-trust laws. Thus an 8-yr pattern of peace between labor and industry is threatened, the last major shutdown coming in 1950.

Industry Counters—Soft coal operators have suggested as a middle road that Mr. Lewis end his 11-yr refusal to qualify for elections under the Taft-Hartley Act. Mr. Lewis has balked at a matter of principle at signing non-Communist

affidavits required for qualification under the Taft-Hartley Act. The owners are convinced that most non-union mines, which produce more than one-fifth of the nation's soft coal, would accept unionization if National Labor Relations Board votes were held.

Two Issues—If some compromise is reached and talks do get into swing major topics will be wages and the welfare royalty. Nothing, as yet, has been said about new wages, but there is the belief that the bituminous industry may be willing to up the daily wage base. Mr. Lewis will probably also request an increase of 10c a ton to the present welfare royalty of 40c a ton.

It is also reported that notice has been served for termination of the United Mine Workers Union contract with the anthracite industry, effective January 1. A 60-day notice of termination is required under the hard coal contract as under the separate bituminous contract. With January rushing closer it remains to be seen what will be done in the way of compromise by both sides.

Shipping Costs: Rail v. Pipeline

Taking issue with a recent article, W. C. Schafer, freight traffic manager, Western Maryland Railway Co., writes the editor of *Coal Age*, as follows:

"As one of the railroads which originate a substantial amount of coal tonnage as well as participating in a large amount of coal traffic moving overseas, we were very much interested in the article on p 52 of the October issue
(Continued on p 52)



Coal's HQ in D. C.

The Coal Building, shown in the architect's rendering at the right, will be erected at 17th and DeSales Sts., N. W., Washington, D. C. National Coal Association recently signed the construction contract for the \$1 million building which is to be ready for occupancy early in 1960.

The new headquarters will be heated by two Coal-Pak automatic packaged boilers (see p 74, this issue). Facing will be mottled-black precast granite slabs, and window frames will be aluminum with gold anodized trim. NCA will occupy the first four floors, and other industry groups will set up headquarters here.

Charles H. Tompkins Co., Washington, is contractor; architects are Clas & Riggs, also of Washington. The new building is across the street from the Mayflower Hotel. Construction is to begin next month.

you can make over 250 different cable connections—

with O-B Cap Screw Connectors!



Straight-Thru Connector



Three-Way Connector Plate



Tee Connector

Actually, you can make a total of 259 different cable connections with the complete line of O-B "Cap Screw" Cable Connectors—and make all 259 with the same $\frac{1}{2}$ -inch hex wrench!

You can join copper to copper, copper to aluminum, or aluminum to aluminum cables, same size or different size, to make straight-thru, tap off, or three way connections wherever and whenever needed—faster than ever before possible!

All connections have high mechanical strength, high current-carrying capacity. All can be easily taped, dragged over rough bottom without snagging.

Ask your local O-B representative or write today for complete information on these time-, labor-, and money-saving O-B Cap Screw Connectors!

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People in Coal



Hugh B. Lee Sr.



Hugh B. Lee Jr.

The Lees of Maumee

CAREERS SPANNING COAL, metal and nonmetallic mining in Canada, the U. S. and overseas, and including positions from millman and engineering hand to president and vice chairman of the board of directors distinguish the Lees of Maumee. The Maumee is the Maumee Collieries Co., of Terre Haute, Ind., and the Lees are Hugh Bertram Sr. and Jr. Both moved up another notch in October—Hugh Sr. to vice chairman and Hugh Jr. to president.

Hugh Sr. was born in Columbus and was a printer's devil at age 11. But the mining profession attracted him and he graduated from Ohio State with a Mine Engineering degree in 1912. His Alma Mater, incidentally, recently honored him as one of its outstanding graduates. The Deadwood cyanide mill, Mogollon, N. M., was the site of his first postgraduate job. A year and a half later he went to Canada as a millman for Porcupine-Crown Mines, Ltd. Meantime, he had wed Ruth Horton and Hugh Jr. arrived July 29, 1917, at Timmins, Ontario, where Hugh Sr. by that time was manager. Closing of the property in 1918 resulted in a new job of developing a chromite property, which in turn shut down in 1921. This prompted a move to Florida and a job as superintendent for the Phosphate Mining Co.

In the summer of 1923, O. Stanley Roberts, a classmate found himself the proprietor of a stripping organization in Indiana, and to him Hugh Sr. was the man to take over. In the years of improvement and expansion since, Hugh Sr. also

found time to function in several industry agencies and organizations, as a stripping consultant overseas, and as the spark-plug for several significant advances in operating equipment and techniques. He was the leader, for example, in the introduction and development of the big walking dragline and the modern vertical drill. He built the first all-welded preparation plant and, through his part in the development of Akremite, revolutionized blasting practices in stripping and open-cut mining.

Like his father, Hugh Jr. took his degree at Ohio State, where his studies encompassed both engineering and business administration, interspersed by vacation service in the Maumee engineering department. Upon graduation in 1938 he started full time with Maumee as assistant sales manager, becoming successively sales manager, vice president—sales, executive vice president and president.

Service in World War II as an ensign on the staff of Admiral Cooke, of the Seventh Fleet, appears on the Hugh Jr. record. He married Eleanor Ray Young Dec. 30, 1938, and the family now includes one boy and three girls, compared to two boys and one girl for Hugh Sr. Like his father, he pulls his share of the load in coal-industry organizations and in addition is active in civic affairs in Terre Haute and the surrounding areas where Maumee properties are located. He plays a good game of golf, while Hugh Sr. enjoys winter cruises and summer swimming at his own camp.

Gene Shockey is superintendent of Jensie mine at East Springfield.

W. E. Smith has been named manager of maintenance and purchasing for the West Virginia and Ohio Divisions, with headquarters at Mammoth, W. Va.

W. E. Patterson now is superintendent of West Virginia operations, including

two operating mines, a central cleaning plant, Kelley's Creek R. R. and the River tippie.

William G. Kegel has been promoted to general master mechanic of Vesta-Shannopin Coal Div., Jones & Laughlin Steel Corp., California, Pa. Mr. Kegel

had been assistant general master mechanic.

Harry M. Tibbs, administrative assistant to the president, Truax-Traer Coal Co., was elected president of Kanawha Coal Operators Association at Charleston, W. Va., Oct. 16. Paul

The *GOODMAN* Performance Report



The GOODMAN 965 Loader

How to load out High Production in low Coal

The answer comes from a prominent mine in West Virginia where coal height averages a low 38 to 40 inches. Here, the working combination of a Goodman Type 965 Loader and three Goodman Type 870 Shuttle Cars loaded out and moved 473 tons of raw coal from 19 locations in one shift. The crew of eight averaged 59 tons per man. Average shuttle car load was 3.3 tons.

With an over-all height of 26½ inches, a clean up width of 7'1", gathering arm strokes of 55 per minute and complete maneuverability, the Goodman 965 loaded out coal in a steady profitable flow to the rugged Goodman 870 low vein shuttle cars. At a loaded speed of 4 mph, the cars quickly carried the coal to out-mine conveyors. Pacing the fast-working face equipment at this mine are Goodman Ropebelt conveyors in room panels and main haulageways.

The GOODMAN 870 Shuttle Car



Wherever Goodman machines are put to work, you can be sure of outstanding performance, high production and increased profits. For example, the 965 Loader . . . Goodman engineers powered this unit with four 20 hp continuous rated motors to give constant, even power under all loading conditions . . . long, rugged life and low maintenance.

Let us show you how Goodman machines can team up in your mine for higher production . . . greater profit.

*The 965 Loader and 870 Shuttle Car, as well as other Goodman models for higher coal, are available for either D.C. or A.C. operation.

GOODMAN

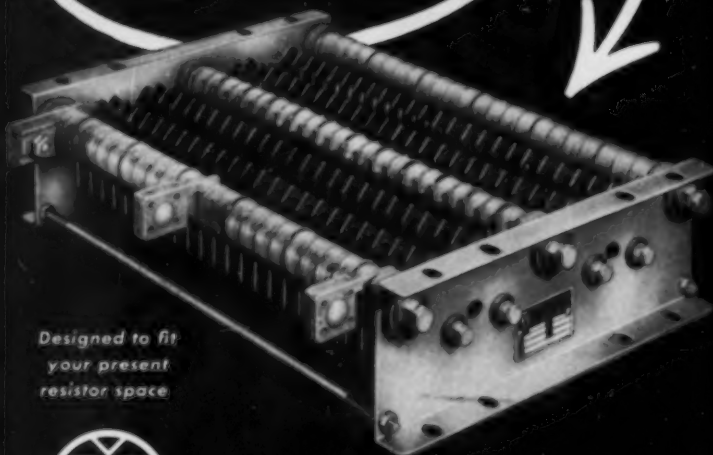
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CUTTING MACHINES • CONVEYORS • LOADERS
SHUTTLE CARS • LOCOMOTIVES • CONTINUOUS MINERS

Use Genuine Goodman Replacement Parts

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Designed to fit
your present
resistor space



STEEL GRID RESISTORS

**consistently prove their value in
MINING SERVICE**

- Steel Construction
- Mica Insulation
- Corrosion Resistant
- Vibration Proof
- Moisture Resistant
- Provision for Expansion
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- Rugged Terminals

By use of these durable raw materials . . . steel and mica, and the P-G exclusive features of design, these steel grid resistors have the "built-in quality" to overcome factors which often cause resistor failures. Vibration, moisture laden or corrosive atmospheres have little effect on continuity of service. Try Post-Glover Resistors for heavy duty applications where resistors are subject to severe service . . . continuous "Trouble-Free" performance is assured.



The Non-Failable Steel Grid Resistor

THE POST-GLOVER ELECTRIC COMPANY

OFFICE and FACTORY—Kenton Lands Road, Erlanger, Kentucky

MAILING ADDRESS—Box 709, Covington, Kentucky

People in Coal (Continued)

Morton, president, Cannelton Coal & Coke Co., was elected vice president, and L. Newton Thomas, president, Carbon Fuel Co. was named treasurer. Harry G. Kennedy was reelected executive secretary.

Officers of Independent Mineral Producers' Association were elected at the annual meeting Oct. 30, as follows:

Board Chairman, William C. Altwater; president, William L. Harger; vice president, Clifford Turner; executive vice president, F. H. Mohney, and secretary-treasurer, J. P. MacFarlane.



George A. Stachura has been named assistant vice president of operations, Bell & Zoller Coal Co., Johnston City, Ill. He was formerly superintendent of No. 9 mine, Old Ben Coal Co., West Frankfort, Ill. In his new position Mr. Stachura will supervise coal production at all Bell & Zoller properties. He started his mining career as a hand loader in western Pennsylvania mines. His first supervisory position was as a safety director at Harwick mine, Duquesne Light Co., near Pittsburgh. Long active in youth welfare activities, such as Scouting and Little League baseball, Mr. Stachura has become a well-known figure in mining and civic affairs in southern Illinois.

Supervisory appointments at operations of Warner Collieries Co., Mammoth, W. Va., have been announced by Myron Kok, vice president, as follows:

W. T. Patterson has been named assistant general manager of the Ohio and West Virginia Divisions, with headquarters at East Springfield, Ohio.

A. C. Young has been appointed preparation engineer for Ohio and West Virginia operations.

Paul Toth is now general mine foreman, Eastern Gas & Fuel Associates, Federal No. 1, Grant Town, W. Va. Mr.

HENDRIX

Heavy Duty Mining Buckets



PREFERRED

...for tough stripping jobs

The "MH" is specifically designed and built for greater production at the lowest cost-per-ton in the toughest mining applications.

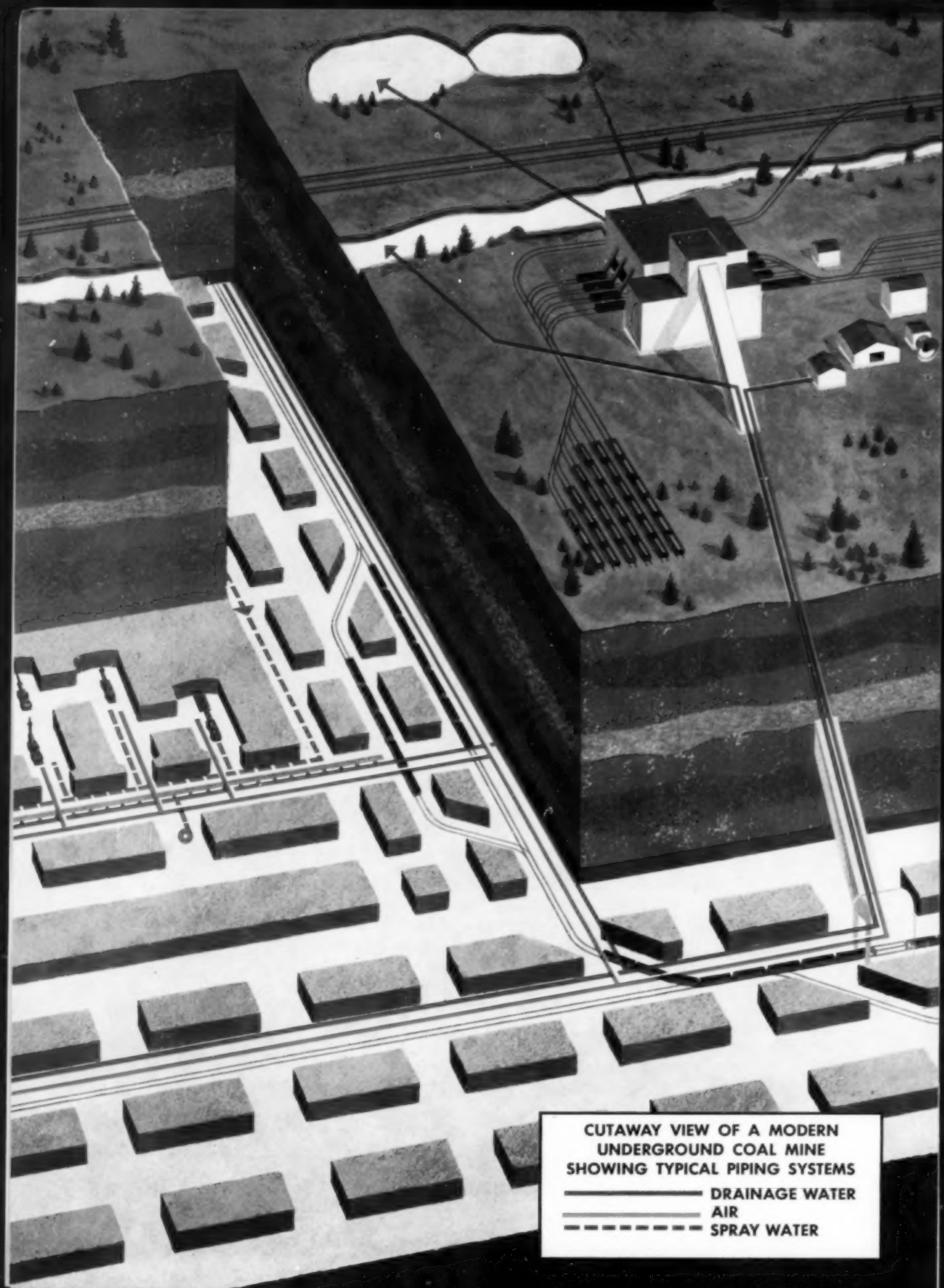
- Higher Arch • Wider Front
- Tapered Basket • Greater Strength

4½ to 14 Cubic Yards with or without Perforations

HENDRIX MANUFACTURING CO., Inc.

MANSFIELD, LOUISIANA





CUTAWAY VIEW OF A MODERN
UNDERGROUND COAL MINE
SHOWING TYPICAL PIPING SYSTEMS

————— DRAINAGE WATER
- - - - - AIR
· · · · · SPRAY WATER

Kaiser Aluminum mining pipe drastically reduces installation and handling costs underground!

Ideal for compressed air lines; spray water lines; mine drainage, filtration and disposal; fuel, steam and water supply lines.

With the emphasis on mine modernization, continuous mining and improved production methods, leading mine operators are finding that Kaiser Aluminum mining pipe meets their requirements as no other pipe can. Here's why:

1 Reduced Costs. Aluminum pipe drastically reduces installation costs underground because it's lightweight, easy to cut and fit (even in the overhead position), and requires a minimum of supports or hangers. And, if you use Schedule 5 aluminum pipe in your system, its initial cost is actually less than T&C Schedule 40 steel pipe.

2 High Speed Installation. Quick connecting couplers and fittings assure the fastest pipe line service for air, spray water or drainage lines. Of particular importance in accelerated mining operations, down time waiting for air or spray water is minimized.

3 Strong, Durable. Kaiser Aluminum mining pipe is made of high strength aluminum alloys to take rough treatment and handling. It easily withstands normal pressures used in mining operations and resists the corrosive attack of mine atmosphere. It won't collapse under vacuum, won't become brittle when exposed to low temperatures.

The advantages of Kaiser Aluminum mining pipe make an important contribution to the coal industry's rapid rate of increased production efficiency. To get all the details on how this strong, lightweight pipe can improve your mining operations and save you money, contact us for the name of your nearest Kaiser Aluminum mining pipe distributor.

For complete information on pipe schedules, sizes, weights and strengths—mail in the coupon now for our free, illustrated booklet, "*Kaiser Aluminum Mining and Construction Pipe*." Kaiser Aluminum & Chemical Sales, Inc., General Sales Office, Palmolive Bldg., Chicago 11, Illinois.



THE BRIGHT STAR OF METALS

See "MAVERICK" • Sunday Evenings, ABC-TV Network. • Consult your TV listing.



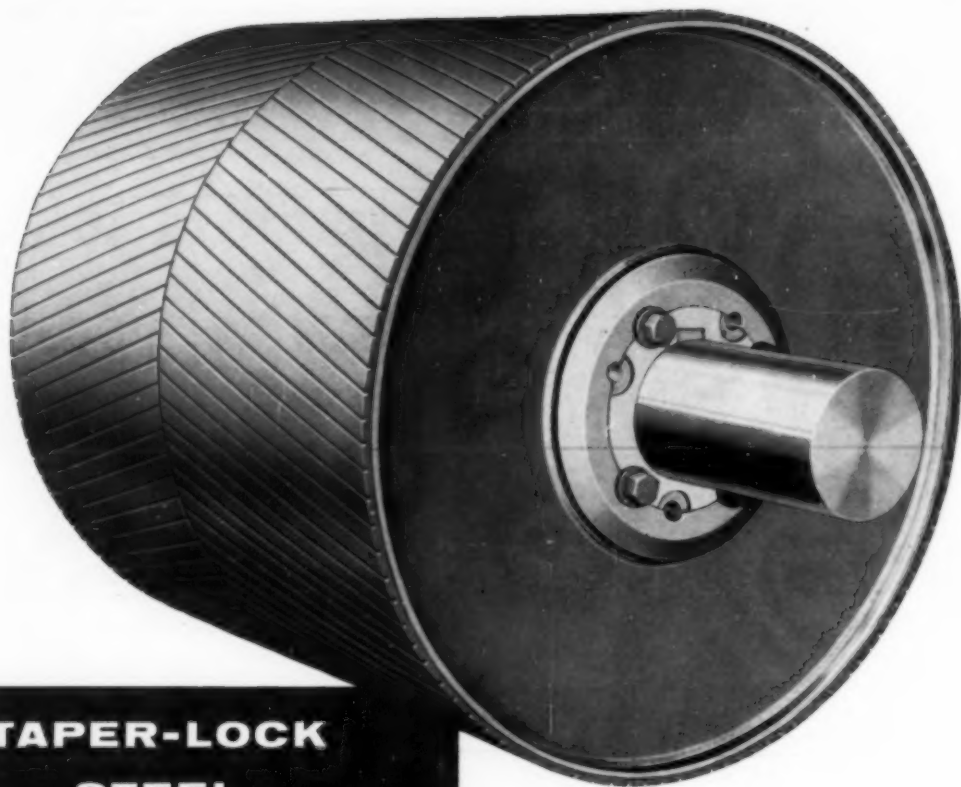
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Dept. PR-854
Palmolive Building, Chicago 11, Illinois

Gentlemen: Please send me your free booklet, "*Kaiser Aluminum Mining and Construction Pipe*."

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TAPER-LOCK STEEL CONVEYOR PULLEYS

Maximum strength with minimum weight...

Unmatched holding power on the shaft...

New mounting simplicity.

The rims, discs and hubs of these modern conveyor pulleys are *steel*—and they are fused together into jointless drum construction for (1) maximum strength with minimum weight, (2) exclusion of dirt, water, steam, (3) terrific shock resistance.

With the patented Dodge Back-up Bar, welds of full rim thickness are achieved—and the ultimate in strength is assured by submerged arc process welds.

Taper-Lock Steel Conveyor Pulleys *hold*. Taper-Lock provides the equivalent of a shrunk-on fit—there is no "walking" on the shaft. Mounting and demounting are simple. Pulley and bushings mount as a unit. Alignment is easy. And the tapered bushing is wedged into place merely by turning the mounting screws. It is "unlocked" by using the mounting screws as jack screws.

Available in diameters from 6 inches to 8 feet—all face widths. Standard or special rubber lagging available. Ask your local Dodge Distributor—or write us for bulletin.

DODGE MANUFACTURING CORPORATION, 3000 Union, Mishawaka, Ind.



97 Taper-Lock Steel Conveyor Pulleys are used in this famous conveyor system engineered, manufactured and erected by Hewitt-Robins, Inc., at the Southern Pacific's causeway construction across the Great Salt Lake.

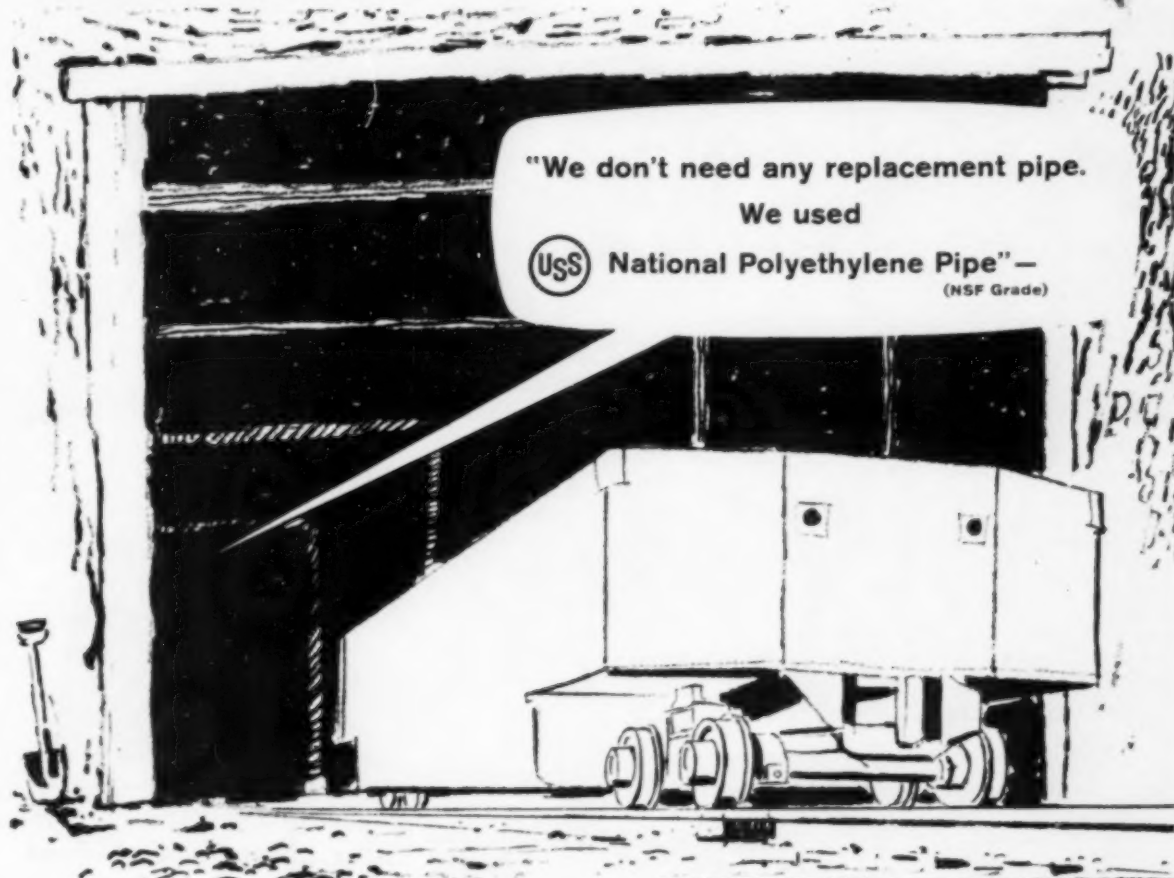
DODGE

of Mishawaka, Ind.



CALL THE TRANSMISSIONEER—your local Dodge Distributor. Factory trained, he can give you valuable help on new, cost-saving methods. Look in the white pages of your telephone directory for "Dodge Transmissioneer."

Subterranean Sam says:



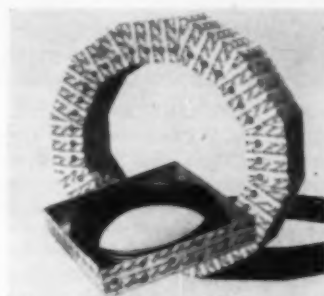
Sam is right. Once USS National Polyethylene Pipe is installed, you can forget about buying replacement pipe; you just won't need any. National Polyethylene Pipe, NSF Grade, offers excellent resistance to corrosive mine water, acids, alkalis, salts and other chemicals existing in coal mines. It's tough enough to resist cracking, even at sub-zero temperatures. It's flexible enough to perform over a working range from -90°F. to $+120^{\circ}\text{F.}$

Installation of USS National Polyethylene Pipe, NSF Grade, is simple and easy. You can carry a roll of this lightweight pipe on your shoulder. It unrolls like hose, turns corners, goes over and under obstructions, requires few joints.

Economical USS National Polyethylene Pipe, NSF Grade, is available in

sizes from $\frac{1}{4}$ " to 6" in diameter and in three schedules. For full details, write to National Tube Division, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

USS and National are registered trademarks



"The world's largest and most experienced manufacturer of tubular products"

**National Tube
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United States Steel

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People in Coal (Continued)



SCHOOL VISITORS AND HOSTS—Pictured during the visit of the NCA Vocational Education and Training Committee to Pennsylvania State University are: John E. Osmanski (seated, left), Island Creek Coal Co.; Henry C. Woods, Sahara Coal Co.; retiring committee chairman; D. R. Mitchell, Div. of Mineral Engineering, Penn State; Roland C. Luther, Pocahontas Fuel Co., Inc., committee chairman; H. L. Hartman, Dept. of Mining, Penn State; Edward E. Tryban (standing, left), Carbon Fuel Co.; Maurice Cooper, former director, NCA Educational Div.; George F. Leatherman, Inland Steel Co.; H. C. Walter, Lorain Coal & Dock Co.; C. E. Dansby, Guyan Eagle Coal Co.; C. R. Nailler, Christopher Coal Co.; C. G. Evans, North American Coal Co.; L. I. Cothorn, Jewell Ridge Coal Corp.; Frank Balcar, B & B Drilling Co. of Ohio; R. F. Campbell, director, NCA Educational Sec.; and James D. Reilly, Hanna Coal Co.



ROOF-FALL PREVENTERS—Arthur S. Macke, vice president (operations) and general manager, Mid-Continent Coal Corp., presents "Certificate of Commendation" to underground supervisors at the Green Diamond mine, Marissa, Ill., for achievements in preventing roof-fall injuries in the year ended June 30. Green Diamond was one of 182 mines that reached the campaign goal of reducing frequency 50% or more, and one of seven in Illinois. Receiving the certificates are: Martin Barber (left), mine manager; Evan Thomas Jr. and Herbert Howard, underground foremen; L. Paul Martin, chief electrician; and Matt Pigford Jr.; George T. Park Jr., and Arthur Ward, underground foremen.

Toth, who came to Eastern as a section foreman in 1938, replaces Fred Pitman, who retired Oct. 1.

Michael M. O'Brien has been made assistant to A. V. Sproles, president of Pocahontas Fuel Co., a division of Consolidation Coal Co. Mr. O'Brien, former

superintendent of the company's Itmann mine, is succeeded by W. J. Skewes, former assistant superintendent. Other promotions are: Hugh Runion to assistant superintendent, Itmann mine; H. H. Morefield to division superintendent; and Howard Boncagione to superintendent of Deerfield mine.

ALLIS-CHALMERS



ALLIS-CHALMERS



NEW brochure of ideas for modernizing

This booklet is based on the premise that modernization can start anywhere in your plant. It can be a single machine or operation . . . a better way of getting variable speed . . . a faster way to braze . . . or a newly available replacement. In fact, this type of updating is far more common than the sweeping change.

Get a copy of "59 ideas for modernization in '59" from your nearby A-C office or write Allis-Chalmers, Industries Group, Milwaukee 1, Wisconsin.

Examples of updating!



New motor development may eliminate premiums you've been paying for specially protected motors.



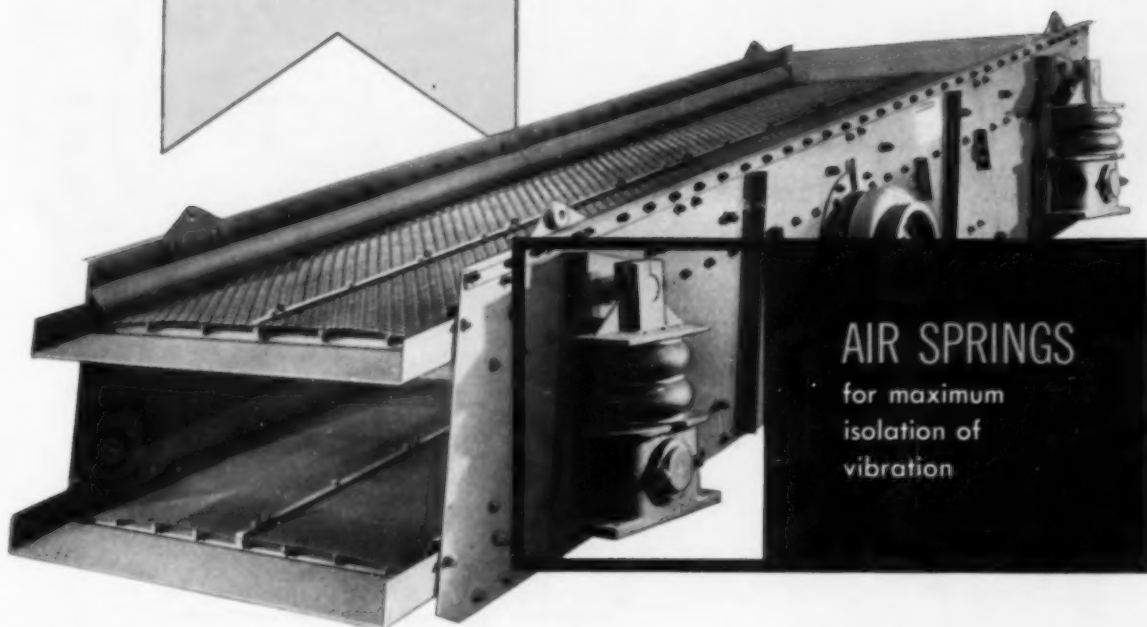
Electrical modernization includes placing substations close to machines being served.

ALLIS-CHALMERS



A-5850

FIRST



AIR SPRINGS

for maximum
isolation of
vibration

**NOW — Allis-Chalmers Vibrating Screens
FLOAT ON AIR**

NEW cars, modern trucks and trains utilize air springs for the smoothest, best controlled ride obtainable. Now Allis-Chalmers has applied the *same type air springs* to *vibrating screens* to provide greatly improved screen performance.

For complete information, see your nearby A-C representative, or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wis. Ask for Bulletin 07B8931.



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C - E R A Y M O N D

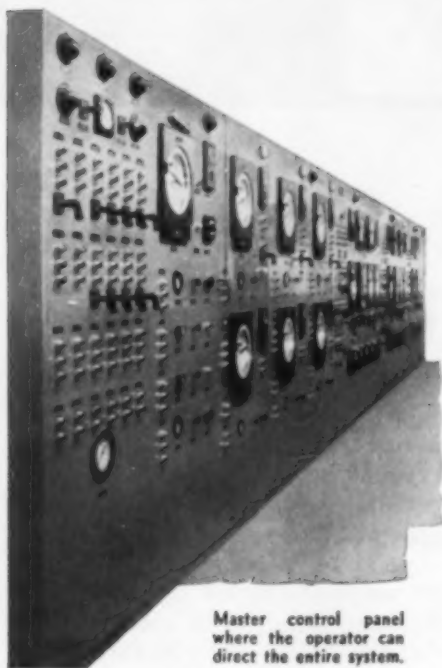
Flash Drying FINE COAL



at an eastern
COAL PREPARATION PLANT

Showing 5 drying columns, and vent stack, served by 3 furnaces.

View of the 5 cyclone collectors and wet scrubbers for dedusting.



Master control panel where the operator can direct the entire system.

The above photographs show a most modern installation of the C-E Raymond Flash Drying System at a very large coal preparation plant in West Virginia.

This plant has an average capacity of 400 tons of "bone dry" coal per hour. The raw feed is $\frac{3}{8}$ " x 0" fine coal with initial surface moisture of $11\frac{1}{2}\%$, which is reduced to a final content of $1\frac{1}{2}\%$.

The C-E Raymond equipment, handling this record production, includes 3 furnaces and 5 drying columns, augmented by 5 cyclone collectors, vented through wet scrubbers for dust control.

The latest automatic features and a single master control panel combine to make this new plant an example of modern push-button efficiency. It is a step forward that presages the future "age of automation" that lies ahead of the coal industry.

C-E RAYMOND Flash Drying Systems are designed for large and small coal preparation plants. Single drying column units are provided for handling from 10 to 100 tons per hour. Multiple columns on one or more furnaces are supplied for higher capacities.

Write for Bulletin FD-51

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weatherproof...with Ashland Permatreat Coal Spray Oil!

- ① **WEATHERPROOF.** Coal sprayed with Permatreat becomes weatherproof, dustproof, waterproof, windproof and non-corrosive. Resists freezing. Eliminates frozen car pockets.
- ② **REFINERY-CONTROLLED QUALITY.** With Ashland Permatreat, you're assured of product uniformity. Permatreat is quality controlled and carefully refined to meet the needs of your operation.
- ③ **TECHNICAL AND RESEARCH SERVICE.** Helpful technical and research services are available to you from our nationally recognized specialists in oil treating of coal.
- ④ **CONVENIENT SUPPLY POINTS.** Large, dependable storage facilities located near the coal fields assure uninterrupted supplies of Permatreat for immediate delivery by tank car or transport truck.

ONE PermatreatMENT LASTS THE LIFE OF THE COAL!

For immediate service call any of these convenient Ashland Oil offices.

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ASHLAND OIL & REFINING COMPANY, Ashland, Kentucky

Coal Abroad

Bigger Mines Planned For USSR

Future production planning will stress the development of big mines and pits. By 1965, the average capacity of the individual USSR mine is expected to be 1½ times present capacity. The output level of mines with a capacity of 2,000

tons and more per day is to be doubled. Some 20% of all underground output is expected to come from mines of this size.

Until now, much Soviet coal production has been hampered by lack of proper underground transport. Modernization plans for big mines, however, are pointing toward use of 12-, 14- and 20-ton heavy electric engines, each

capable of hauling cars of from 3 to 10 tons capacity.

Development plans also call for:

1. Increasing the level of enriched coals from 38% of total output in 1957 to 50% in 1965.
2. Centralizing enriching plants with a capacity of not less than 1,200,000 to 1,500,000 tons each.
3. Opening new mines in the Donbas and Kuzbas regions during the next 7 to 10 yr.

Together with continuing discoveries of new oil and gas fields and planned development of rich Yakutia coal deposits, new mines in the Donbas and Kuzbas regions should assure an abundant supply of Soviet coal for both domestic and export use. Russia's coal output is now equal to or above that of the U. S., twice that of England and eight times that of France.



for tough coal screening operations

CF&I SPACE SCREENS

Manganese—CF&I Manganese Space Screens, made of ¼" or heavier wire, are extremely shock-resistant. This type of screen takes crushing, tumbling, pounding in stride, lasts longer on scalping operations or similar tough screening jobs. Eliminate needless, costly downtime . . . get CF&I Manganese Space Screens.

Other CF&I Space Screens for Coal Screening Operations include:

Wissacloy—a rugged, economical, general-purpose screening tightly woven of

carefully crimped special alloy steel wire. **Stainless Steel**—a durable, unexcelled quality screening for washing and other operations where wet, corrosive materials must be processed.

Whatever your coal screening requirements, there's a CF&I Space Screen designed for the job. Furnished in a wide range of standard dimensions, CF&I Space Screens can be supplied with the edge preparation you specify. Contact the CF&I sales engineer in our office nearest you.

CF&I SPACE SCREENS THE COLORADO FUEL AND IRON CORPORATION

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5923

GREAT BRITAIN

Largest S-E Station

Britain's Central Electricity Generating Board is planning its largest coal-fired steam-electric station with an installed capacity of 1.5 million kw. The new station, to be known as Plant C, will be constructed with government approval at Drakelow in the Midlands.

Two coal-fired stations already are in operation at Drakelow: Plant A of 240,000-kw capacity, and Plant B of 480,000-kw capacity. Plant A went on line in 1954 and Plant B will begin operations before the end of this year.

Drakelow was selected as the site of this concentration of generating power because it is (1) on the fringe of the East Midlands coalfield, one of Britain's main sources of low-grade coal, (2) in the center of the industrial, power-demanding Central Midlands and (3) at the focal point of Britain's new 275,000-V supergrid transmission system. Power from the three plants can be fed directly into the system without construction of new transmission lines.

INDIA

Buying U. S. Machinery

The Indian National Coal Development Corp. is reportedly making arrangements to purchase approximately \$5 million worth of coal mining machinery under U. S. defense excess property provisions.

The equipment, although considered outdated by American standards, and offered to overseas countries at 5% of



MINING
MACHINERY
EXHIBITION

GRAND HALL
OLYMPIA · LONDON
9th-18th JULY 1959

THE COUNCIL OF UNDERGROUND MACHINERY MANUFACTURERS

Coal Abroad (Continued)

its face value, is stated in India to be a "very good buy."

Three engineers of the coal development corporation recently visited the U. S. and now recommend the purchase, as does India's purchasing mission in Washington. All equipment will be carried from the U. S. in Indian vessels. Money for the purchase comes out of a \$150 million Export-Import Bank loan to India, and must be used only to buy capital equipment in the U. S.

OVERSEAS FLASHES

AUSTRIA—Increasing imports by Austria of coal from East Europe is an attempt to increase Austrian exports of goods to these coal-selling states. In the last quarter of this year Austrian coal imports will include 339,000 tons of Polish coal, 129,000 tons of Soviet coal and 95,000 tons of Czech coal. At the same time, imports from West Germany will fall to 226,000 tons, against 450,000 in the same quarter last year.

EAST GERMANY—The East German

economy is to double its industrial production value in 1965 as compared with the 1957 level of activity. This makes necessary higher imports of raw materials from the USSR. In a mid-October trade agreement the Soviets promised to ship 1,600,000 metric tons of coke per year to her westernmost satellite, as compared with 928,000 tons in 1957. In return, East Germany will ship more machinery, chemicals and products of the consumer-goods industries to Russia in payment.


RUSSIA—Industrial output of the Soviet Union was 10% higher than last year for the first three quarters of 1958, according to recently released figures. Coal production for this period was put at 371 million tons. Despite apparent increased construction of mines and soaring production, Soviet economists believe that coal will decrease from 76.8% of the total Soviet fuel consumption (expressed in caloric units) in 1950 and 67.2% in 1957 to merely 36.5% in 1972.

ENGLAND—An old saying will soon fall prey to natural consequence. Outsiders will soon have to carry coals to New-

castle. The Montague colliery, last of the coal mines in Newcastle, announced recently its seams were almost worked out after 450 years of mining.

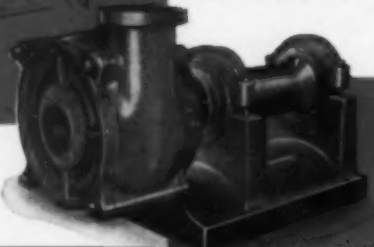
RHODESIA—An oil from coal industry may soon be set up in the Federation of Rhodesia and Nyasaland, backed jointly by the Rhodesian Federal Government and the Anglo-American Corp. of South Africa (which, despite its name, has no American capital and is backed by British and South African financial interests). Anglo-American owns the only colliery in the Federation, at Wankie in Southern Rhodesia, and with a new hydro-electric power plant soon to open, the corporation anticipates little success in finding export markets for the surplus coal which will result. In neighboring South Africa the Government has established a \$126 million oil from coal scheme at Sasolburg which is now producing 25 million gallons a year and which has a target of 55 million gallons.

GREAT BRITAIN—Britain may try to regain part of its European coal market by cutting its small coal prices up to \$3.50 a ton, according to reports.

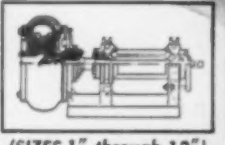


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DURABILITY PLUS
By using the same
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that adds 5 to 6 times to
the life of conveyors, chutes,
launders, hoppers, etc.



(SIZES 1" through 12")

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I Ordered Kelly Repair Parts.

KELLY MANUFACTURING CO.

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MIDDLEPORT, OHIO

Coal, Overburden or Refuse...

"EUCS" CUT HAULING COSTS



Rear-Dump and Bottom-Dump Euclids have earned their reputation for more work-ability and low cost tonnage on scores of open pit operations. Built expressly for hauling big payloads in off-highway service, they have the speed, capacity and stamina to move more tons per shift... with minimum downtime and maintenance expense.

Bottom-Dump Coal Haulers have payload capacities of 25, 40 and 51 tons... are powered by engines of 218 to 360 h.p. with Torqmatic Drives and standard transmissions. Rear-Dump "Eucs"—for coal, overburden and waste—are available in 10 to 50 ton capacities... have engines of 128 to 670 h.p. with Torqmatic and standard transmissions.

Euclid Scrapers and the TC-12 Crawler are top performers on stripping operations, too. They cut costs of overburden removal, building and maintaining haul roads, stockpiling, clean-up and other open pit jobs.

Check the complete "Euc" line for the advantages that apply to your operation... a Euclid dealer can show you facts and figures proof that Euclids are your best investment.

EUCLID Division of General Motors, Cleveland 17, Ohio



EUCLID EQUIPMENT

FOR MOVING EARTH, ROCK, COAL AND ORE



The round-taper shank
that eliminates setscrews!



Round, tapered shank has 78 sq. in. area . . . 57% greater than standard $\frac{1}{2}$ " x 1" bit shanks. Extra shank area makes the CC-7 bit more resistant to breakage and bending.

NEW CARBOLOY® CC-7 BIT SAVES YOU MONEY 2 WAYS

The CC-7, a new concept in bit design, gives greater efficiency with continuous boring machines. It combines these advantages for use in toughest coal formations:

1. **57% larger cross-section** than ordinary $\frac{1}{2}$ " x 1" shanks is more resistant to breaking and bending. Heat treated, forged steel shank has 1" diameter at the gauge line.
2. **Elimination of setscrews** cuts downtime for bit changes. Precision machined taper automatically seats and holds CC-7 securely; a

flat on bottom of shank positions bit and keeps it from rotating. To remove bit, just use a wedge or drift pin.

This bit, like all the others in the complete line of Carboly Mining Tools, is stocked by your local Authorized Carboly Mining Tool Distributor. For additional information, or in-mine assistance, call him today. (He's listed in the Yellow Pages under "Mining Equipment.") Or write: Metallurgical Products Department of General Electric Company, 11120 E. 8 Mile Street, Detroit 32, Michigan.

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GOLD LINE
MINE BELTING

- **STRONGER**
- **LIGHTER**
- **MORE DURABLE**

...moves more tons
—more years



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East of the Mississippi

SCANDURA Gold Line Mine Belting—acceptance designation "Fire Resistant U.S.B.M. 28-1"—is more productive because it stays on the job longer without expensive repair. Solid-interwoven, SCANDURA takes a beating without tearing or ripping. With no plies to separate, this great belting is highly flexible—small pulleys can't damage it. Lighter, less bulky SCANDURA trains perfectly, troughs naturally whether empty or loaded, has *two top sides*—thanks to its polyvinyl impact cushion on both faces. • Talk belting with your National Mine man . . . then let SCANDURA Gold Line speak for itself!

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**HEAVY DUTY
FLOOD LAMPS**
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Current Coal Patents

By Oliver S. North

Hydraulic conveyor take-up, H. D. Seigle and D. D. Ziegler (assigned to Joy Mfg. Co., Pittsburgh, Pa.), Oct. 14, 1958. An endless chain, flight conveyor is provided with an improved hydraulically-operated take-up device for the chain, for automatically taking up any slack introduced in the chain as the conveyor is swung laterally at either one or both of its ends. No. 2,856,061.

Mine roof supports, J. A. W. Mills and H. L. Holt (assigned to Dowty Hydraulic Units Ltd.), Oct. 21, 1958. Design for a mine roof support consisting of inner and outer tubes with a single row of telescopic, hydraulically-operated props. No. 2,857,125.

Mine stall loading machines, J. Quoniam (assigned to Saarbergwerke, Saarbrück, Sarre, France), Oct. 28, 1958. Design for a machine with a high yield adapted to load cut coal. The machine progresses along a stall that is being undercut, and is separated from the belt conveyor by a line of pit props. The apparatus has a collapsible loading arm which is narrower than the spaces between adjacent props, and is adapted to slide horizontally and transversely between the props. No. 2,858,005.

Mining apparatus of the pivoted boom type, J. D. Russell (assigned to Joy Mfg. Co., Pittsburgh, Pa.), Oct. 28, 1958. An improved hydraulic mounting is provided for the pivoted vein-attacking and disintegrating mechanism of a continuous mining machine. This mounting is compact, powerful, and rugged. No. 2,858,121.

Means for effecting sequential discharge of a series of material breaking cartridges, J. C. Hesson and J. A. Swanson (assigned to Cardox Corp., Chicago, Ill.), Nov. 4, 1958. An apparatus is provided for introducing compressed gas through a single supply tube to successively operate a plurality of blasting cartridges of the type that discharge automatically at a given pressure. No. 2,858,764.

Tensioning device for flexible support strands of an endless conveyor, R. F. Risse (assigned to Goodman Mfg. Co., Chicago, Ill.), Nov. 4, 1958. As a take-up for flexible support strands of an endless conveyor, the strands are wound on hydraulically-driven winches which are mounted for movement with respect to the tail section of an extensible conveyor. The winches maintain adequate tension, yet are capable of

readily paying out or reeling in strand when the conveyor is lengthened or shortened. No. 2,858,932.

Extensible conveyor, J. W. Hardy (assigned to Goodman Mfg. Co., Chicago, Ill.), Nov. 4, 1958. In an extensible belt conveyor, means are provided for maintaining the belt under proper tension at all times without subjecting the head unit to compressive forces from the tensioning winch. The winch is ground supported independently of the head unit. No. 2,858,933.

Extensible strand sideframe conveyor, M. G. Carlson and C. T. Ogden (assigned to Goodman Mfg. Co., Chicago, Ill.), Nov. 4, 1958. In an extensible sideframe conveyor, the winding drum is provided with locking means in the form of a pawl and ratchet, whereby the drum is locked against unwinding but not against winding. No. 2,858,934.

Extensible conveyors, R. F. Lo Presti (assigned to Goodman Mfg. Co., Chicago, Ill.), Nov. 4, 1958. Method and apparatus for maintaining desired tension in the support strands of a conveyor wherein the conveying reach is supported upon laterally spaced flexible strands. A snubbing drive is provided for the strand, and the tension is varied in both the snubbing drive and the slack end of the strand when the conveyor is either stationary or while its length is changing. No. 2,858,935.

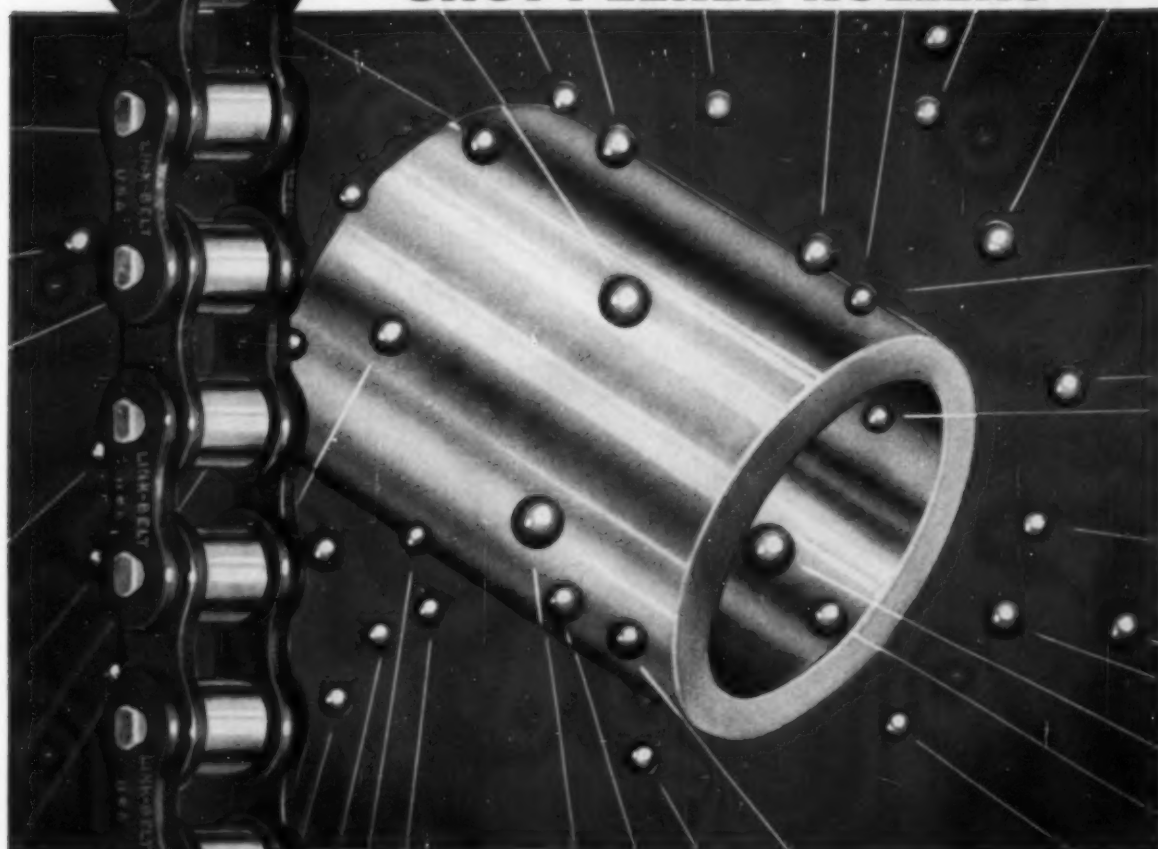
Tension conveyor apparatus for flexible support strands of an extensible conveyor, C. T. Ogden (assigned to Goodman Mfg. Co., Chicago, Ill.), Nov. 4, 1958. Control means are provided for conveyor strand tensioning devices which are effective, during tramming, to keep the tension in the strands unchanged. The apparatus senses the initial tension and thereafter maintains that tension value during the tramming actuation. No. 2,858,936.

Hydraulic roof supports and conveyor feed jacks, C. M. Frye (assigned to Dowty Mining Equipment Ltd., Tewkesbury, England), Nov. 4, 1958. Design for mine roof support units, each of which comprises a framework having two or more hydraulic props supporting a roof bar and connected by hydraulic feed jacks to a structure such as a conveyor framework. The conveyor may be advanced behind the working face in a progressive snaking movement under the force of several feed jacks. Thereafter, each support unit may be drawn towards the conveyor and the face by its feed jack. No. 2,859,022.

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***AIR SEAL resin process...**

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- Binds shell and strata together into one solid mass at anchoring end of bolt.
- Absolutely permanent anchorage — impervious to oxidation, water, oil, gas or acids. Ideal for haulageways and airways which must remain open for many years.
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- Resin is pre-packaged in convenient container — no spilling — no contact with workman.

*U. S. Pat. No. 2,829,302. Other patents pending in the U. S. and foreign countries.

Mine operators have long sought a simple and safe solution to the problems of bolting in soft, failing roofs. After many years of research and in-the-mine testing, Pattin has perfected this revolutionary and completely different AIR-SEAL resin process. This patented method, designed for use with expansion shells and bolts, features an air sealing plastic resin in a special container. Each container holds the exact amount of resin needed for one bolt hole.

The process requires no special equipment for use. The container is simply inserted into the bolt hole ahead of the expansion shell and bolt, and pushed into place. The container is crushed between the shell and the end of the bore hole when the bolt is in place and tightening begins, releasing the plastic resin to flow over, around and into the shell and surrounding strata. It cannot run down the bolt, due to sealing washers and an expanding gasket under the shell. The resin solidifies quickly into a tough, adhesive mass, due to fast-acting chemical action. The tremendous holding power and permanence of this new process multiplies the effect of a regular bolt and shell many times and secures the anchorage for many additional years.

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Pattin expansion shells and Air-Seal process are available and serviced exclusively by The Colorado Fuel and Iron Corp., Denver, Colorado. Western mining companies should contact them direct for information and consultation.



The PIONEER of roof bolting . . . established 1888



PATTIN

MANUFACTURING COMPANY
MARIETTA, OHIO

News Roundup (from p 28)

of *Coal Age*, entitled, "Dry Pipelining . . . Natural Gas v. Coal." This article apparently is based upon statistics prepared by Mr. Theodore Nagel.

"We are unable to reconcile the cost per million Btu's indicated by Mr. Nagel for handling coal by rail. If we interpret Mr. Nagel's remarks correctly, he uses a figure of \$3.00 per ton per 100 mi for coal handled by rail, which would mean \$15.00 per ton freight charges on coal to a distance of 500 mi.

"In the Eastbound Coal Case, which was recently before the Interstate Com-

merce Commission in Docket 31437, the average distance from 81 mines in the Base District Group to Housatonic, Mass., was 501.9 mi via the short traffic route. The freight rate for this distance is \$5.48, including all increases. If we add to this amount the \$3.00 coal which Mr. Nagel has used, we arrive at a total transportation-and-coal cost of \$8.48 per net ton. Using bituminous coal with a 12,500-Btu analysis, the cost by rail would be 34c per million Btu's, whereas Mr. Nagel's scale indicates that the cost would be in excess of 70c.

"Using a further illustration of a power plant at 600 mi burning an

equivalent of 1 million tons per yr, the cost of fuel is \$3 million, and using his figure of \$3 per ton per 100 mi the transportation cost is \$18 million. The total cost is \$21 million using bituminous coal.

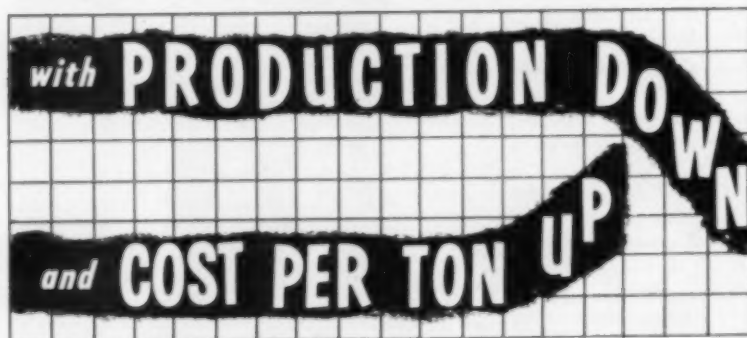
"While Mr. Nagel's scale does not indicate cost per million Btu's for a distance of 600 mi, the rate of progression for the distance up to 500 mi indicates that his cost by rail would be somewhere in the neighborhood of 80c per million Btu's.

"The actual situation is that using again the average distances from the base group placed in the record of the Eastbound Coal Case, the mileage from the base group to Worcester, Mass., would be 610.9 mi via the short tariff route from 81 different mines. The rate for this distance including all increases is \$5.70 per net ton, which is 34.8c per million Btu's, using 12,500-Btu coal.

"While Mr. Nagel does not indicate the saving to the power plant at 600 mi, coal by rail v. coal powder by pipeline, his figures apparently became so distorted using his yardstick that it was impossible to detail that factor.

"It is our opinion that the true picture should be shown to clarify any misunderstanding that might be gained from Mr. Nagel's information. Based on the foregoing information, the cost of coal by rail would be somewhere between Mr. Nagel's estimated cost of coal powder by pipeline and that of natural gas. We cannot agree with the conclusions Mr. Nagel has reached."

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With Continuous Miners and Other High-Rate Equipment at the face—YOU CAN'T AFFORD PRODUCTION-HESITATION at the loading point! The ONE, SURE WAY to avoid it is with STAMLER Car spotters. Get the facts on STAMLERs Now! The Savings are PARTICULARLY important to the SMALL mine. Write, wire or phone for complete information.



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Awards Re-Offered

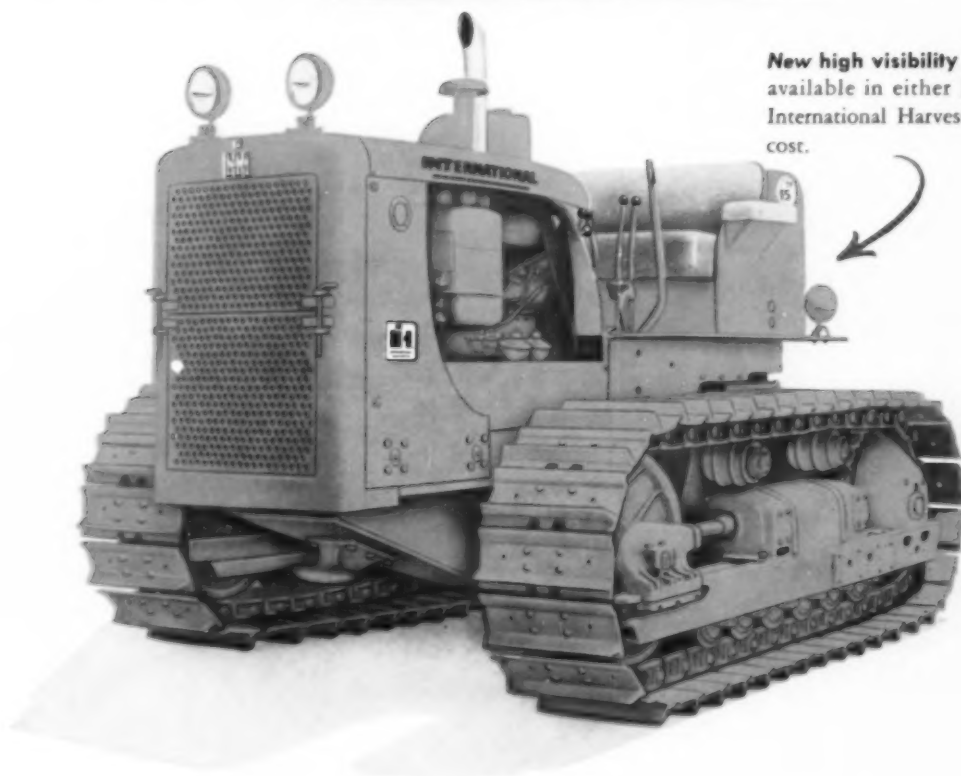
Johnstown Coal & Coke Co., and its subsidiary, Williams River Coal Co., again offer two university scholarships in mining engineering with a value of \$750 a year for 4 yr, or a total value of \$3,000. The scholarship student may attend any accredited school of mining engineering, and the company will try to employ them during summer vacations. Following graduation, the student may seek employment wherever he desires. The new awards are open to students in the following Pennsylvania high schools: Adams-Summerhill, Beaverdale, Wilmore or Portage area; West Virginia: Cowen, Crichton, Nicholas County, Richwood or Webster Springs.

R. J. Taft Rejoins Coal Age Staff

Dick Taft, formerly an assistant editor with *Coal Age*, has returned from military service to take over at his old post. Mr. Taft, a graduate of Dartmouth College, holds a BA degree in English and has studied writing and law. He will

NEW International TD-15 tops 100-hp field...

with exclusive power and control features!



New high visibility color. Optionally available in either Federal yellow or International Harvester red at no extra cost.



6-cylinder diesel

power . . . 105-hp fully-proven D-554 engine—full 20,500 lbs drawbar pull.



6-speed full-reverse transmission

. . . 20% higher reverse speeds. A speed for every work or travel need plus fast "Shuttle-Bar" direction changing!



Precision control

Foot Decelerator for instant speed changes —fast "Shuttle-Bar" forward-reverse travel.

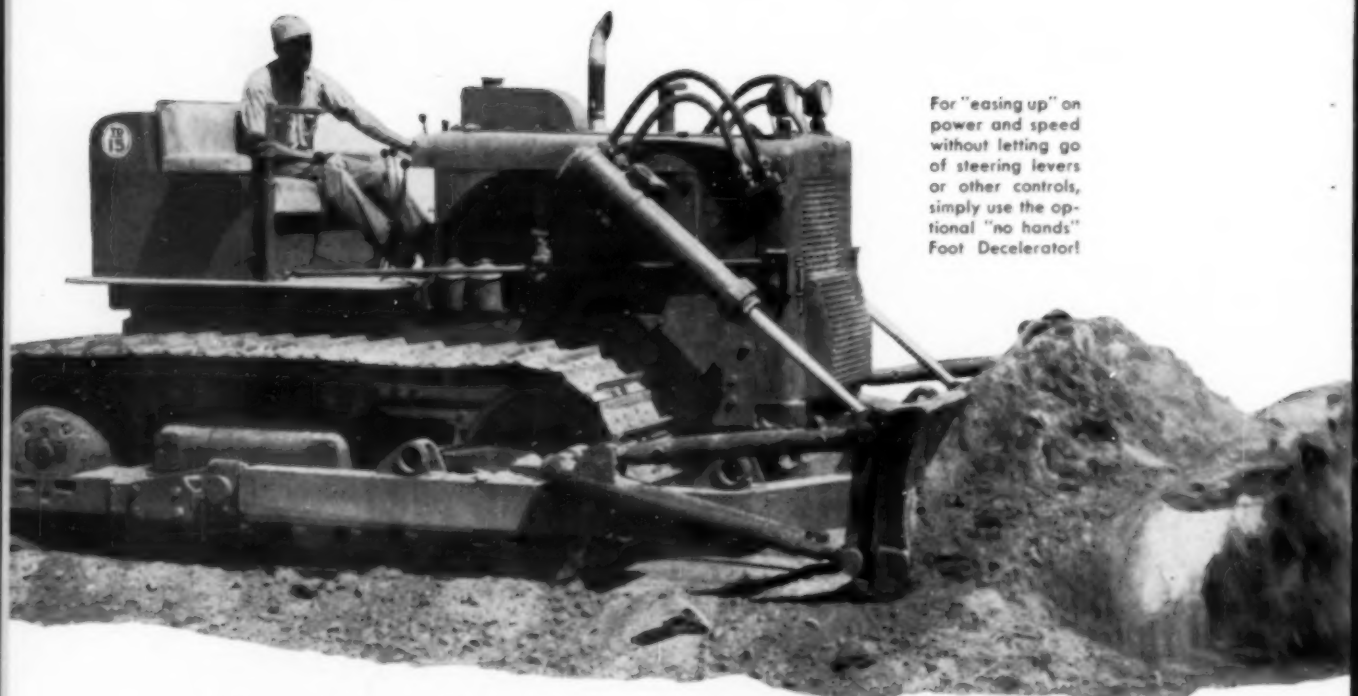


1,000-hour lube interval, heavy-duty track rollers

. . . heavy-duty, long-life bushing type, with extra capacity lube reservoir.

...and here's the pay-off for you...

You move in on...and speed up **....with NEW TD-15**



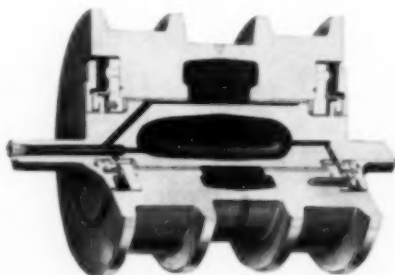
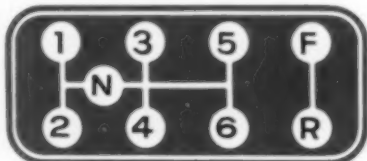
For "easing up" on power and speed without letting go of steering levers or other controls, simply use the optional "no hands" Foot Decelerator!

Exclusive six-speed "single stick" shift ... forward and reverse "Shuttle-Bar"

You shift through all six speed ranges of the new TD-15—forward or reverse—with a single lever. Shift pattern is planned for gear-changing ease and speed with a fast sweep of the hand—to give you instant use of the speed you need. To speed the work-cycle and take full advantage of fast shifting, you simply push or pull the "Shuttle-Bar"—to change TD-15 forward or reverse instantly.

1,000-hour lube interval, heavy-duty, track rollers

Not just another "claim" . . . International now combines heavy-duty *bushing design*, exclusive cartridge-type *metal-to-metal seals*, and king-size lube reservoirs, to offer the industry the first heavy-duty type roller as standard equipment on the TD-15. Thick shells for safe build-up and exclusive pressure relief passages for flush-out and prevention of seal damage from power lubricators are part of this new design.



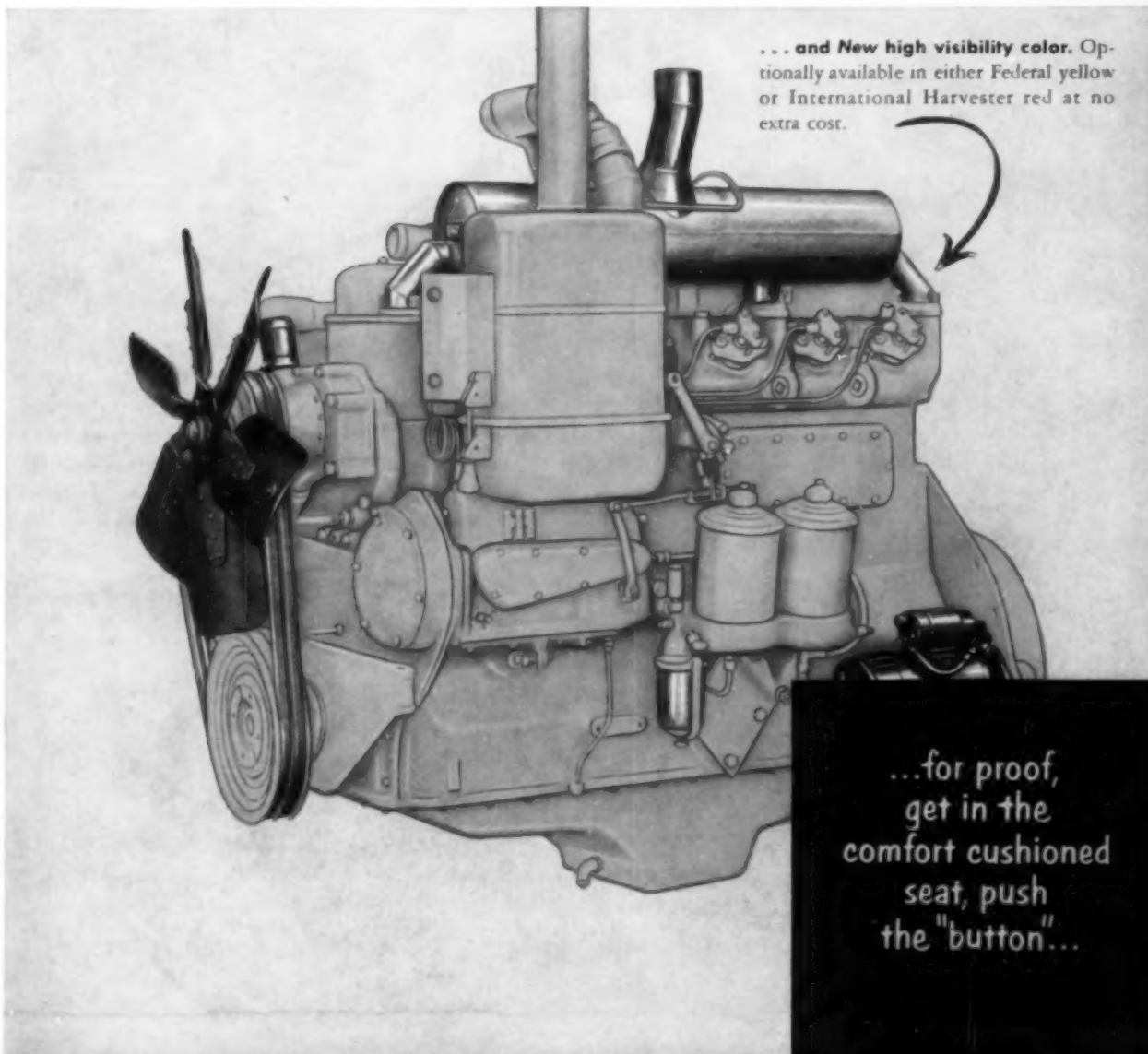
...a whole new range of jobs... **capacity and control**

Smooth 6-cylinder... BIG 105 IH diesel horsepower

You get 6-cylinder smoothness from this new International D-554 diesel engine that powers the new TD-15. This fully-proven power plant produces its 105 net hp at 1,650 rpm... features famous International 45-degree angle operation full-flow lubrication, closed pressurized cooling, exclusive twin plunger pump fuel injection system, fully counter-balanced crankshaft, positive valve rotators, and all-weather

gasoline conversion starting. Here's an engine built for long life, big-capacity output!

New power, strength, control, and reliability features like these show you how and why the 105-hp TD-15 tops its field. You move in on a new range of heavy jobs—material-moving, land-clearing, hauling, loading, excavating, logging, mining—that no longer belongs to next-size-bigger crawlers!



... and New high visibility color. Optionally available in either Federal yellow or International Harvester red at no extra cost.

...for proof,
get in the
comfort cushioned
seat, push
the "button"...



Compare TD-15 performance to anything in the 100 hp crawler field!

Prove to yourself you can move in on, and speed up, a whole new range of heavy jobs—with new TD-15 capacity and control. Put the TD-15 through its paces—compare *power, speed, capacity, and control* to anything else on tracks in the 100 hp field. The 6-speed full-reverse transmission and "Shuttle-Bar" will show you on-the-job how fast, easy, and profitable shuttle-cycle operations can be! Press the de-

celerator and see what a helper this feature can be for actually speeding up operations—by reducing de-clutching and shifting time! Measure sintered metal, dry-type clutch full power transfer efficiency and maintenance, ease and economy to any other crawler's clutch—wet or dry! See your International Construction Equipment Distributor for a new TD-15 demonstration!

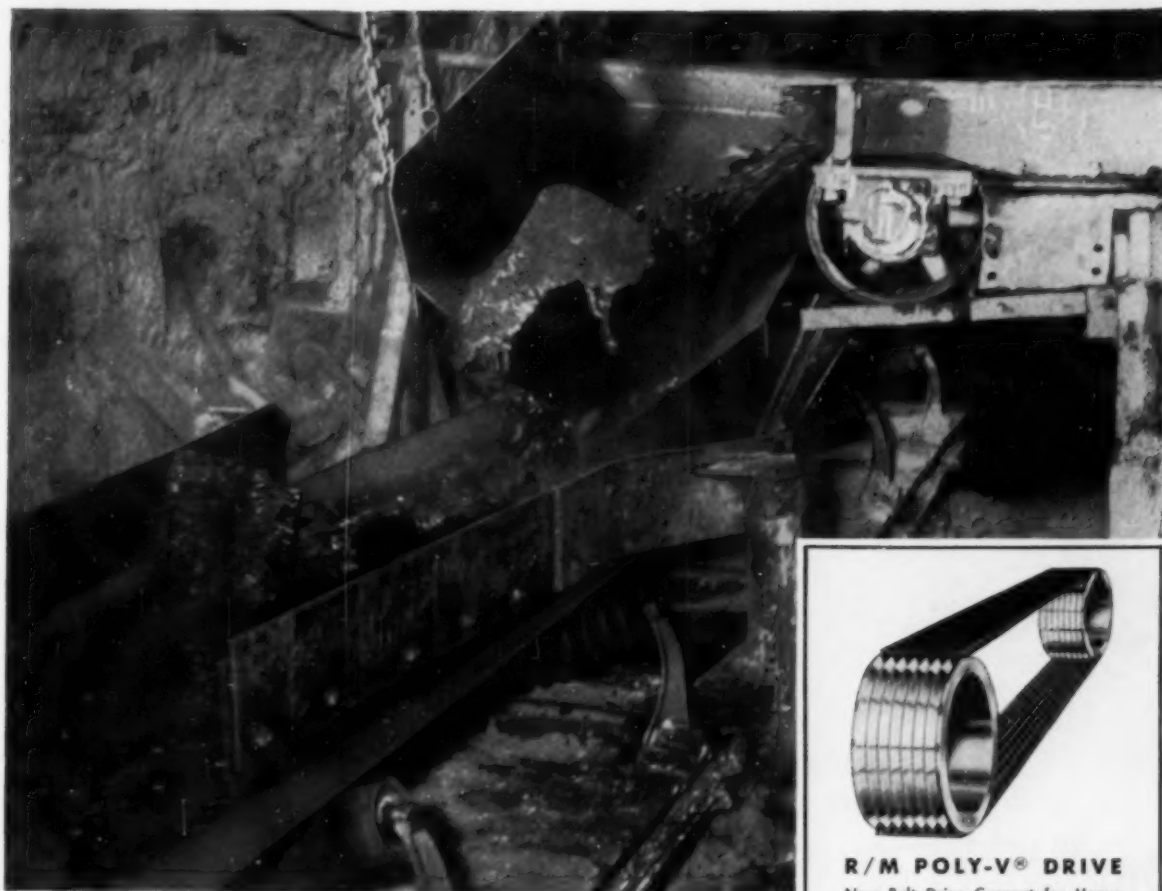
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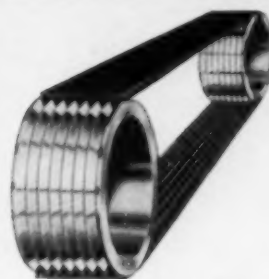
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It's the *last* one-third of conveyor-belt life that determines its final cost. R/M engineers recognize that every belt feature — troughability, resiliency, fastener holding ability, strength member fabric, cover toughness and thickness — all help determine the *true* cost of Ray-Man Conveyor Belt on your job. That's why every Ray-Man component is precision proportioned to assure better belt balance where it pays off most for you — in longer belt service life!

Let an R/M representative show you how these features add up to "More Use per Dollar" on your job . . . with Ray-Man and other R/M heavy duty belts.



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New Belt Drive Concept for Heavy Duty Power Transmission. Eliminates V-belt matching problems. Delivers up to 50% more power in the same space as regular V-belts . . . or equal power in less space!

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*Poly-V is a registered Raybestos-Manhattan trademark.

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- Moisture Resistant, Mildew-Proof

Available in Special FIRE RESISTANT Construction with Bureau of Mines' Acceptance Designation: "Fire Resistant, U.S.B.M. No. 28-10."

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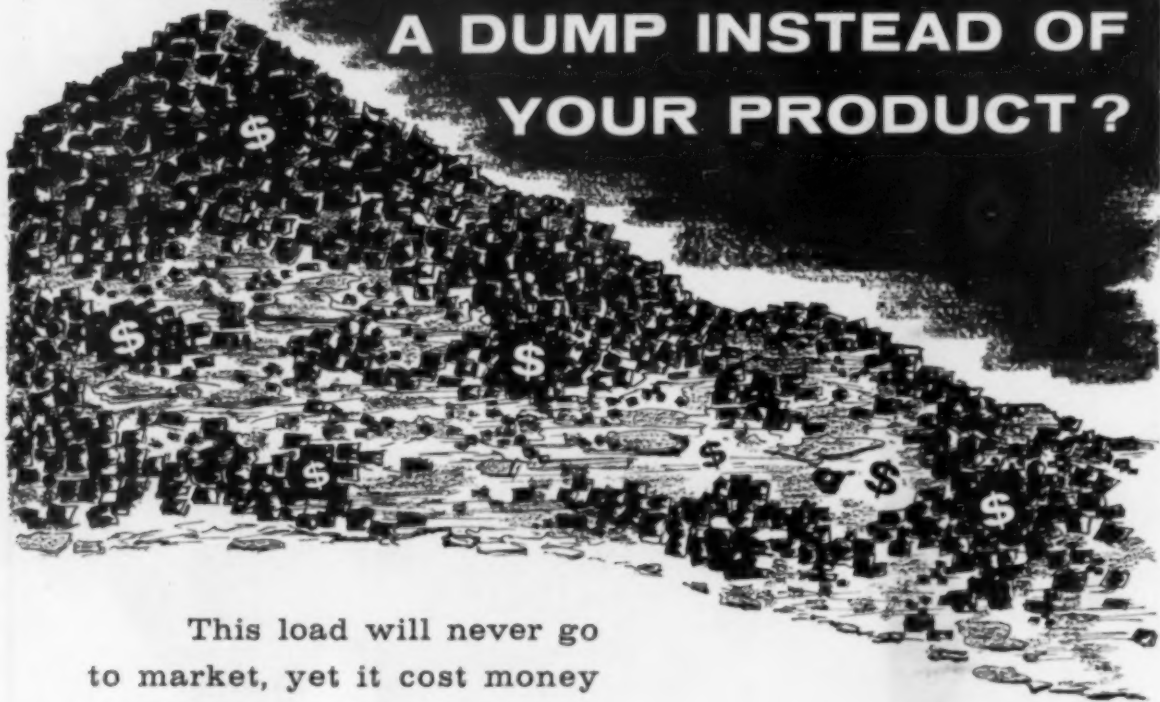
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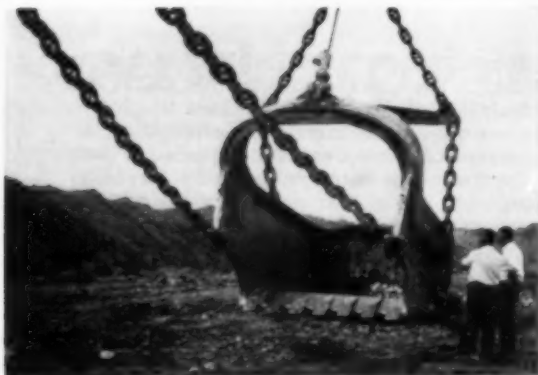
Call Fairmont, W. Va. 1672 and a Fairmont Engineer will consult with you and analyze your facilities for possible cost and savings.



"T-1" Steel bucket scoops 20% more load

—weighs 17,000 pounds less

—saves 50% of bucket costs



This USS "T-1" Steel bucket holds about 29 cubic yards loaded due to the unique fabricated lip design worked out by Mr. Miller. The former 25-yard rated bucket actually retained about 24 cubic yards loaded.



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United States Steel

Warren Miller, master mechanic for Maumee Collieries Co., Terre Haute, Indiana, designed and built this bucket for one of the firm's large dragline rigs. He knew that capacity could be raised, over-all weight reduced and maintenance simplified if he fabricated the bucket entirely from plates of USS "T-1" Constructional Alloy Steel of 321 Brinell hardness.

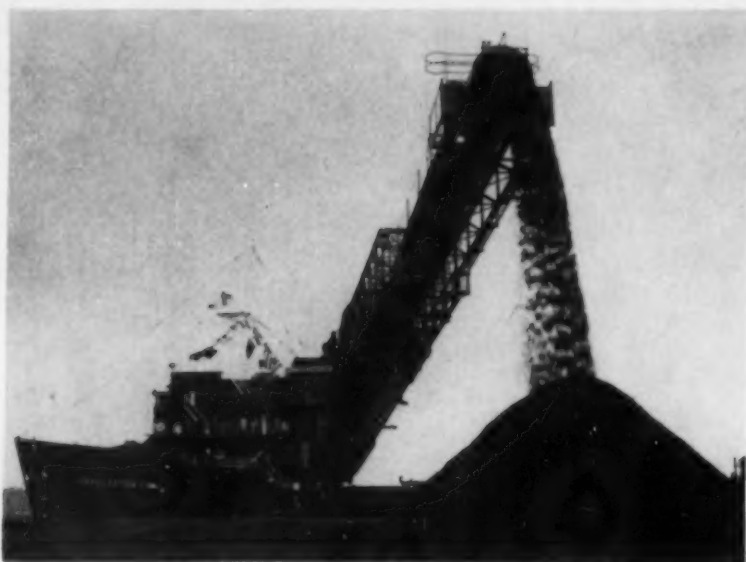
Weight reduction. The bucket formerly used weighed 30 tons fully rigged, and scooped an average load of about 24 cubic yards. The new USS "T-1" Steel bucket weighs only 26 tons but delivers a load of 29 cubic yards—a capacity gain of 20% and an empty weight reduction of 25%. The loaded weight reduction is about 1%. Work per shift is up.

Cost reduction. Thanks to USS "T-1" Steel, the cost of this bucket was less than previous replacement costs. And a check on wear for the first four months of use indicated that the all "T-1" Steel bucket should last longer than buckets previously used. Maintenance will be simpler, too; no castings are used. The entire bucket is welded of plates.

Tooth talk. Maumee's bucket teeth are also made of "T-1" Steel instead of castings. They last about five weeks—two weeks longer than castings—and cost about half as much. All the "T-1" Steel used in the bucket was furnished to 321 Brinell which gives it extraordinary resistance to impact abrasion. USS "T-1" Steel is also available with a minimum yield strength of 100,000 psi.

Write for free book. The many advantages, applications and cost-saving features of this versatile steel are well known by equipment makers and completely described in our book, USS "T-1" Constructional Alloy Steel. United States Steel, Room 2801, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

USS and "T-1" are registered trademarks



BIG AND FAST—The S.S. *Consolidation Coal* here ushers in a new era in ocean transportation of coal as she begins discharging her 24,000-ton cargo at a rate of 1 ton per second at Salem, Mass., Oct. 27, for the Salem Harbor station of the New England Power Co. Flying the flag of the Pocahontas Steamship Co., the ship eliminates the need for conventional discharging facilities and thus effects considerable cost savings.

News Roundup (Continued)

handle the news department of *Coal Age* as well as duties in production. With his return, the *Coal Age* staff stands at six editors.

Drilling, Blasting Symposium

The School of Mines and Metallurgy and the Center for Continuation Study of the University of Minnesota working jointly with the University, the Colorado School of Mines and Penn State University, held the Eighth Annual Drilling and Blasting Symposium on Oct. 2-4 at Minneapolis. The meeting followed previous trends of combining the knowledge and talents of research and development with those in operations in order to solve the problems of drilling and blasting. The papers as well as the discussion will be published in the forthcoming Proceedings of the Symposium. Those interested may contact the Center for Continuation Study at the University of Minnesota for purchase of copies.

BECOLOY Makes the Difference On This Digging Dragline Bucket



Bucyrus-Erie BECOLOY buckets are built to outlast . . . designed to outstrip! BECOLOY, an exclusive alloy, makes the buckets tough . . . cuts weight while increasing strength. Performance-tested tooth and lip angle make them dig in fast, slice through smoothly for faster filling.

New-design Bucyrus-Erie BECOLOY buckets ride through the swing smoother because they're better balanced to cut bobbing and spillage. The dump is quick and complete, cutting seconds off every cycle.

See your distributor for details on light, medium, and heavy-duty types, solid or perforated.

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BECOLOY is used on arch, clevis plates, lip, and teeth. It has a tough, fibrous structure that imparts high strength.



What this tag on OKOCORD portable cords and cables means to you

This "QC" (Quality Control) tag, the final one of a series, is Standard Operating Procedure for every length of OKOCORD before it is shipped out to you. It's your assurance that Okonite's modern equipment, skilled craftsmanship and overall Quality Control program combine to build more value into OKOCORD portable cords and cables.

Here are six other steps, typical of all OKOCORD manufacturing operations, where quality is constantly checked and maintained by the Quality Control Lab and every operator and supervisor in the plant.

1. QC Lab tests copper rod, raw materials against Research-developed standards to maintain uniform, high quality.
2. Strands are continuously drawn, annealed and steam cleaned with every run passed for size, strength, flexibility.
3. Compounds are mixed, milled, strained and refined in a continuous mechanized sequence to help eliminate error.
4. Microscopic examination of compound batches, in addition to physical and electrical tests, checks particle dispersion and authenticates compounding.

5. Latest type of continuous lead extruder eliminates damaging press stops in applying continuous mold for vulcanization—guarantee of OKOCORD's "tire-tread" toughness.

6. Okonite QC imposes the most rigorous tests in the industry, in process and final.

Each reel of OKOCORD bears this quality control tag. It's your assurance that the OKOCORD you buy will be a long-term investment. The Okonite Company, Passaic, N. J.

Buy through your distributor.

Write for this newly-published 64-page catalog on OKOCORD. Full information on construction components, cable assemblies, dimensional tables, engineering data plus splicing and terminating drawings and instructions.



where there's electrical power . . . there's **OKONITE CABLE**

6379

Low labor and handling costs . . .
Efficient, maintenance-free service



PORTABLE PIPING of ALCOA ALUMINUM

for temporary water supply or drainage •
compressed air • steam • fuel

When your piping services call for lines that must be installed or moved frequently, portable piping of ALCOA® Aluminum is your best bet. Here's why:

It's portable—More aluminum pipe can be carried per truck. Fewer trucks are needed for every job. Each workman easily can handle several standard lengths of aluminum pipe at one time. Large quantities of pipe can be laid by small crews in a minimum number of man-hours.

It's economical—Low labor and handling costs, added to its long service life, make ALCOA Aluminum Pipe less expensive than other piping on an installed cost-per-foot basis.

It's strong and durable—Thin walled ALCOA Aluminum Pipe has very good mechanical properties. Properly used, it will handle adequately most pressures encountered in temporary lines. It provides good resistance to mechanical damage. And the excellent natural corrosion resistance of aluminum eliminates costly maintenance and replacement under severely corrosive operating conditions.

ALCOA Aluminum Pipe and quick couplings of aluminum are available through most major oil field supply companies. You'll find the one nearest you listed in the Yellow Pages of your telephone directory. Your local distributor can furnish you with detailed literature containing complete specification data on ALCOA Aluminum Pipe. Or, you can obtain that literature by writing ALUMINUM COMPANY OF AMERICA, 924-M Alcoa Building, Pittsburgh 19, Pa.



Mines, Companies

Exploration work is in progress at properties of Spring Canyon Coal Co., Carbon County, Utah, with the objective of developing the "D" seam.

The announcement was made as Spring Canyon, Standardville and Royal Coal Cos. changed ownership. New owner and president of the three companies is M. F. Van Horn, Fresno, Calif., who is also in the oil and liquefied petroleum gas business. Spring Canyon suspended operations recently. Some of the 140 furloughed miners have since returned for the exploration work.

Operating management of Glen Alden Corp. recently met with sales executives of Blue Coal Corp. to explain plans for increasing production efficiency at Glen Alden's anthracite properties.

H. B. Wickey, vice president of Glen Alden, outlined plans for rebuilding the operating company into a compact, well-balanced unit. Also emphasized was the role Glen Alden plays in the community and revitalization of the company as a growing segment of the anthracite industry. Blue Coal Corp. handles sales of Glen Alden's product.

Youghiogeny & Ohio Coal Co. is adding new coal-handling facilities at Nelms No. 2 mine, Hopedale, Ohio.

The company is adding a Nolan Rotary car dump and Nolan car-feeding equipment to handle 550 tph of r-o-m coal. The dump hopper will feed a 42-in transfer belt conveyor which discharges onto a 1,600-ft-long slope belt. Probable completion date is sometime during the first quarter of 1959. Prime contractor is Industrial Engineering & Construction Co., Inc., Fairmont, W. Va.

Construction and operation of the projected new Segco No. 1 mine will be taken over by the Alabama By-Products Corp., Birmingham, as a result of agreement between ABC and the Southern Electric Generating Co., jointly owned by the Alabama and Georgia power companies.

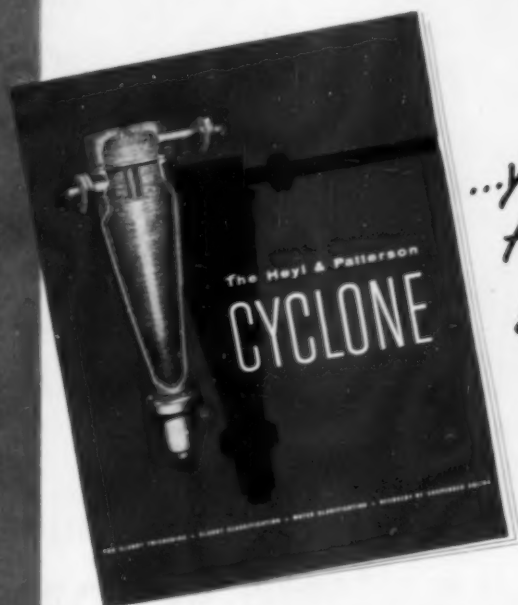
When completed, the new mine, near Parrish, Ala., will produce around 1,500,000 tons per year and employ around 400 men, according to P. H. Neal, ABC president. The coal will be used by a new 1,000,000-kw steam plant now being constructed near Wilsonville, Ala. The first two of four generating units are expected to be in operation by the summer of 1960.

Fire Nov. 2 destroyed the preparation plant and conveyor line at the Louellen (Ky.) plant of the Cornett-Lewis Coal Co.

Estimated damage is between \$250,000 and \$300,000. The mine had been leased since May 15 to the Joe Knob Coal Co.

now...

for the first time, a Cyclone brochure filled with facts, tables, recovery curves . . .



...yours
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asking!

When you are concerned with

→ **Slurry Thickening...**

→ **Slurry Classification...**

→ **Water Clarification...**

→ **Recovery of Suspended Solids...**

return the coupon and receive complete information about the performance, design and practical application of the H & P Cyclones.

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HEYL & PATTERSON, INC., 55 Fort Pitt Blvd., Pittsburgh 22, Pa.

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Company _____

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City and State _____

With industry everywhere



the No. 1 choice is the V-belt with concave sides

It is easy to see why concave sides insure far longer belt life...and make Gates V-Belts the first choice of industry everywhere.

Just make this simple test: bend a Gates V-Belt as if it were going around a sheave. Feel how the concave sides (Fig. 1) fill out ... become perfectly straight (Fig. 1-A).

Note how this belt thus makes full contact with the sides of a sheave... grips the sheave evenly, distributing wear uniformly across the sides of the belt. Uniform wear lengthens belt life — keeps costs down.

With a straight-sided belt (Fig. 2) the sides bulge out when the belt is bent, and wear is concentrated on the bulge (Fig. 2-A). Uneven wear shortens belt life — increases belt costs.

Because Gates V-Belts with concave sides are so universally preferred, they are also the most widely available. There are Gates Distributor stocks in industrial centers throughout the world.

The Gates Rubber Company, Denver, Colorado



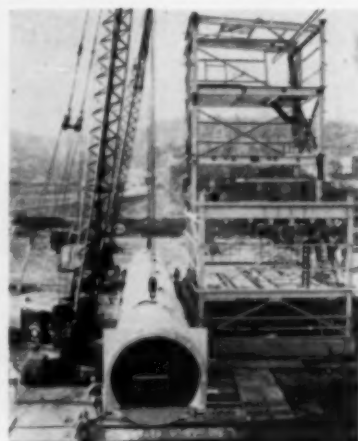
World's Largest Maker of V-Belts

TPA 351

Gates VULCO ROPE Drives

Mines and Companies (Continued)

after 40 yr of operation by Cornett-Lewis.



A 111-ft long belt-conveyor tube which will transport coal from the transfer house to the clean coal bin is readied for hoisting at Maple Creek mine, U. S. Steel's new development in New Eagle Borough, Washington County, Pa.

By 1959, the firm expects 500,000 tons of mine-run coal to be the new mine's annual production. U. S. Steel's Clairton Works will convert the coal into coke for the blast furnaces, coal chemicals and coke oven gases for the reheating furnaces of the corporation's basic steel plants in the Pittsburgh district.

It is reported that the Navy Fuel Supply Office in Washington, which purchases coal for all facilities of the Armed Services and the Defense Department, has expanded its procurement period from 4 to 8 mo.

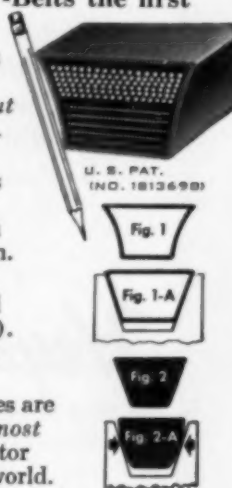
As a result, invitations are being issued currently on sizeable tonnages for delivery in 1959 and 1960.

Survivors of the Springhill, Nova Scotia, mine disaster have been offered jobs by SeaPac Corp., a fishery employing about 700 people.

The firm, located in Georgia, and some Canadian maritime provinces, operates freezing and packing plants. SeaPac's executive vice president, Tom Pearce Jr., also made the offer to the miners' wives, it is reported.

The Dominion Coal Co. announced recently that none of the Springhill mines would reopen.

Springhill No. 2, where 74 men died as a result of a bump which occurred Oct. 23, was the only one of the company's mines in operation. The mine employed about 900 men. A statement from Dominion Coal officials said: "The company will cooperate to the best of its ability with proper government





Latest Stoper Drill Development Simplifies Roof Bolting in Low Coal

Le Roi-Cleveland S-20 Vac-Nu-Matic stoper, with new feed principle, is only practical machine in seams from 36" down to 26". Other sizes available for any seam height.

28-inch feed S-20 weighs only 65 pounds. It is the lightest dust-collecting type stoper available—operators say it's easier to use.

The revolutionary S-20 stoper is designed especially to provide a better way of producing roof-bolt holes.

Low coal or high coal makes no difference to this machine. It lets you put your roof-bolts wherever you need them—even in 26-inch coal. And high drilling speed along with light weight and a positive dust-collection system helps your miners get the work done faster.

New feed principle provides low overall height and longer travel. The S-20's feed consists of an air piston combined with a chain in such a way that the travel of the machine is double the travel of the feed piston. As a result, it drills a deeper hole with one steel change than a standard stoper does with two changes.

Because it does away with at least one steel change and in some cases two, this longer travel saves roof-bolting time.

The low overall height is obtained because the S-20 is the only stoper that starts its feed at the bottom of the machine. The starting height, regardless of feed length, is always 16½ inches.

Dust collection is instantaneous.

There are no hoods or tubes to handle or adjust, when your miners use the S-20 Stoper. The cuttings and dust are pulled through the drill steel instantaneously and ejected through the side of the chuck housing into the dust box—no cuttings go through the machine itself.

There's complete absence of dust because the S-20 system pulls a high vacuum. It uses only 18 cu. ft. of air at 80 lbs. pressure to pull a static vacuum of 16½ inches of mercury or a fluid vacuum of 13

inches while the machine is running. Wet top presents no problem.

New design speeds roof-bolting operation. The S-20 has been in the field for more than a year, working in all types of coal mines. According to the evidence piled up during this period, S-20 users not only roof-bolt areas heretofore impossible to get at—they also do the work faster.

Features that contribute to this increase in efficiency are: Lighter weight. Low overall height. Longer feed. Positive dust-collection. Fast drilling speed.

Test the S-20 in your mine. See how it reduces roof-bolting costs. A demonstration can be arranged by contacting Schroeder Brothers, 3116 Penn Ave., Pittsburgh, Pa.; Acme Machinery Co., Williamson, West Virginia; Equipment Service Co., Inc., 617 North 9th St., Birmingham, Alabama. Or, you can contact us direct.



LE ROI Division of Westinghouse Air Brake Co., Milwaukee 1,

Wisconsin, manufacturers of Newmatic® air tools, portable and Tractair® air compressors, and stationary air compressors. Write us for information on any of these products.





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BEE-ZEE SCREENS

How you screen your product has its effect on how fast you sell it. Bee-Zee Screens use sharper sizing, better dewatering, and non-clogging features to move mined products faster ... *to make you money.* Special applications and difficult conditions are "everyday jobs" for these stainless steel, precision-welded screens. Engineered in the right size, the right shape and with the right rods for your individual operation, Bee-Zee Screens can be the difference between problems and profit.

Ask your Screening Equipment Manufacturer or write,
wire or phone Galesburg Dickens 2-5155 collect.

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1128 Abingdon Street, Galesburg, Illinois



ROUND ROD SCREEN
long life
accuracy

GRIZZLY ROD SCREEN
rugged
accuracy

TRI-ROD SCREEN
knife-like
accuracy

ISO ROD SCREEN
prolonged
accuracy

GRIZZLY ROD WITH
SKID ROD
ruggedest accuracy

Mines and Companies (Continued)

authorities to meet the difficult situation which the closing of this mine will cause in Springhill."

The announcement was made after a meeting of officials of the town, the provincial government, Dist. 26, UMWA and the company.

Utilization

Aluminum Company of America hopes to have a new steam electric generating plant completed by the middle of 1959.

The Warrick power station being built at Warrick County, Ind., is, say officials of the firm, the most comprehensive use of aluminum ever made in the power generation field. The station, which will supply power to produce about 150,000 tons of primary aluminum at Alcoa's Warrick Works, will be supplied with coal from Alcoa's nearby reserves at Boonville, Ind. Squaw Creek Coal Co., operated by Peabody Coal Co., will mine, prepare and deliver the coal to the power station.

Anthracite will fuel the boilers of the Dallas, Pa. public schools.

A 3-mo controversy over the type of heat to be installed in the Dallas Borough elementary school, in the anthracite region of Pennsylvania, was resolved early in November when the directors voted in favor of a new hand-fired anthracite plant. Oil-fired heating lost after vigorous protests from directors, parents and others.

Bituminous Output

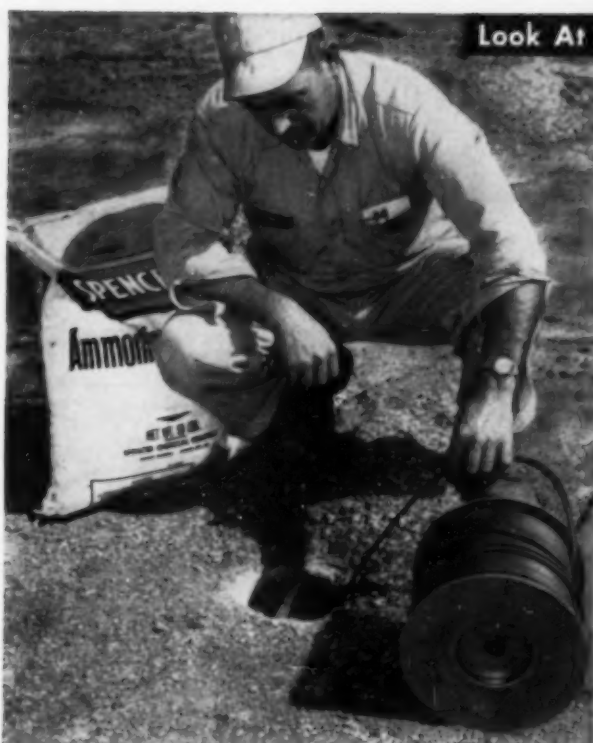
YEAR TO DATE	PRODUCTION
Nov. 15, 1958	344,644,000
Nov. 16, 1957	437,764,000
1958 output 21.3% behind 1957.	
A month earlier output was 22.2% behind 1957.	

WEEK ENDING	PRODUCTION
Nov. 15, 1958	8,585,000
Nov. 16, 1957	9,147,000

Anthracite Output

YEAR TO DATE	PRODUCTION
Nov. 15, 1958	18,777,000
Nov. 16, 1957	22,403,000
1958 output 17.1% behind 1957.	
A month earlier output was 18.8% behind 1957.	

WEEK ENDING	PRODUCTION
Nov. 15, 1958	405,000
Nov. 16, 1957	468,000



Look At One User's Savings With Spencer N-IV:

A typical blast of 21 6½-inch holes at a Midwestern cement plant.

If loaded with all dynamite:

4210# Dynamite (Main & deck charge)	\$829.33
1600' Primacord	50.32
20 M.S. Connectors	10.51
Total	\$890.16

And NOW, with Spencer N-IV Ammonium Nitrate and ¾-inch detonating cord:

4292# Ammonium Nitrate	\$155.15
660' ¾-inch cord	36.30
300' 50-grain cord	9.30
54 Gals. No. 2 Diesel fuel	7.02
20 M.S. Connectors	10.51
Total	\$218.28

Easiest blasting method known . . . just pour oil-soaked Spencer N-IV Ammonium Nitrate into drill hole and detonate with ¾-inch cord.

Most economical blasting method known . . . in this typical blasting operation the saving over dynamite is \$672 or 75%.

User Reports: "Blasting with new Spencer N-IV Ammonium Nitrate

Costs 75% Less Than All Dynamite"

Now—Spencer N-IV gives you the industry's most efficient low cost explosive:

Think of saving 75c of every dollar you now spend for blasting with dynamite. Unbelievable? Not today! These are actual savings reported by a midwestern cement company.

These savings are now possible because of the development of revolutionary new Spencer N-IV Ammonium Nitrate. Spencer N-IV is different from any prilled ammonium nitrate now on the market. Here's why:

1. Increased oil-absorption . . . special structure of Spencer N-IV prills absorbs oil more easily. This gives you easier detonation and a superior blast effect.

2. Reduced priming cost . . . new Spencer N-IV Ammonium Nitrate can be initiated with a single strand of ¾-inch detonating cord. No need for attaching additional material at

intervals, or other complex priming methods.

3. Greater blast energy . . . Spencer N-IV contains a much higher percentage of ammonium nitrate than other brands on the market. Yet it's completely free-flowing—easy to load, easy to shoot.

But that's not all . . . Spencer N-IV Ammonium Nitrate is packaged in rugged new, all-plastic 50-pound bags. Two years of tests show these bags actually are tougher than paper and cut bag breakage as much as 50%. They end the nuisance of leaking oil and dirty bags, too. And, these bags are so moisture-proof they can even be stored outdoors.

Get the facts now about new Spencer N-IV Ammonium Nitrate in polyethylene bags. Tear out and mail coupon today!



MAIL THIS COUPON TODAY!

Spencer Chemical Company
Sales Supervisor,
Industrial Ammonium Nitrate
401 Dwight Building
Kansas City 5, Missouri

☐ Please rush me complete information about new Spencer N-IV Ammonium Nitrate for low-cost blasting.

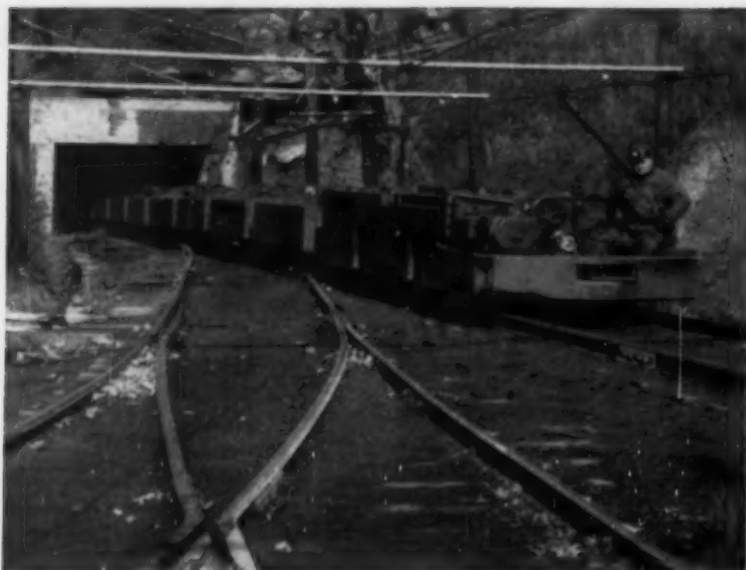
☐ Please have a Spencer Technical Service Representative call—without cost or obligation to me.

Name

Company

Address

City State



A load of coal emerging from the United Pocahontas Crumpler mine. The first Aeroquip Hose Line was installed in 1949 and is still in operation on hydraulic mining equipment.

"We Use Aeroquip Bulk Hose and Fittings to Replace Hydraulic Lines On The Spot"

Says Maintenance Official, United Pocahontas Coal Company, Crumpler, W. Va.

Deep mines like United Pocahontas' Crumpler bituminous mines cut replacement downtime and simplify fluid line maintenance with Aeroquip Hose Lines. Replacement hose lines are made quickly at the repair shop or right in the mine from a portable inventory of Aeroquip Bulk Hose and Reusable Fittings.

Dependable Aeroquip Hose Lines can help cut costs and downtime on your equipment. The Aeroquip Distributor listed in your Yellow Page Phone Book is ready to assist you. Why not call him today?



Aeroquip Bulk Hose and Reusable Fittings are used to make hose lines as they are needed. Only bench tools are needed.



Mechanic Paul Kirby installs a new Aeroquip Hose Line on the central lube system of the mine service truck.

Aeroquip

AEROQUIP CORPORATION, JACKSON, MICHIGAN
INDUSTRIAL DIVISION, VAN WERT, OHIO • WESTERN DIVISION, BURBANK, CALIFORNIA
AEROQUIP (CANADA) LTD., TORONTO 19, ONTARIO
AEROQUIP PRODUCTS ARE FULLY PROTECTED BY PATENTS IN U.S.A. AND ABROAD

Preparation Facilities

Morris Creek Mine, Central Appalachian Coal Co., Montgomery, W. Va.—Contract closed with Industrial Engineering & Construction Co., Inc., for plant addition including Wemco Fagergren flotation cells and an Eimco Agdisc filter to eliminate discharge of solids to streams. Sizes to be treated are minus 28-M plant overflow at a rate of 4 tph, dry solids. Completion date is early 1959.

Equipment Approvals

Eight approvals were issued during October.

Jeffrey Mfg. Co.—Type MT68 shuttle car; three motors, each 10 hp, 500 V, DC. Approval 2F-925A, Oct. 2. [Approval 2-925 covering 250-V shuttle cars of this type was issued April 10, 1953.]

Joy Mfg. Co.—Type 10SC6PH/PXH-11 shuttle car; five motors, one 15 hp, two 10 hp and two 40 hp, 440 V, AC. Approval 2F-1402A, Oct. 9.

Ensign Electric and Mfg. Co.—Type GG distribution box; two 100-amp circuit breakers, 440 V, AC. Approval 2F-1403A, Oct. 9.

Joy Mfg. Co.—Type X-847-19 conveyor drive unit; one motor, 15 hp, 250 V, DC. Approval 2F-1404, Oct. 22.

Ensign Electric and Mfg. Co.—Type KKKKG distribution box; six circuit breakers, four 225 amp and two 100 amp, 220/440 V, AC. Approvals 2F-1405 and 2F-1405A, Oct. 29.

Ensign Electric and Mfg. Co.—Type L distribution box; one circuit breaker, 600 amp, 220/440 V, AC. Approvals 2F-1406 and 2F-1406A, Oct. 30.

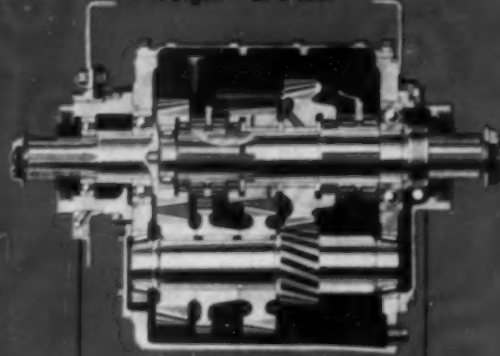
Symbol U.S.B.M. 28-25 was issued to the Russel Mfg. Co., Middletown, Conn., to cover a polyvinyl belt that passed the flame tests successfully.

New Books

Electrical Maintenance

Maintenance Hints has been revised and updated to meet the needs of electrical maintenance men today. The manual is purposely designed to be general in nature and to apply to all types and makes of electrical equipment. It is divided into two general sections, the first covering specific apparatus maintenance and the second covering general

Model 3-A-65
Weight - 270 lbs.

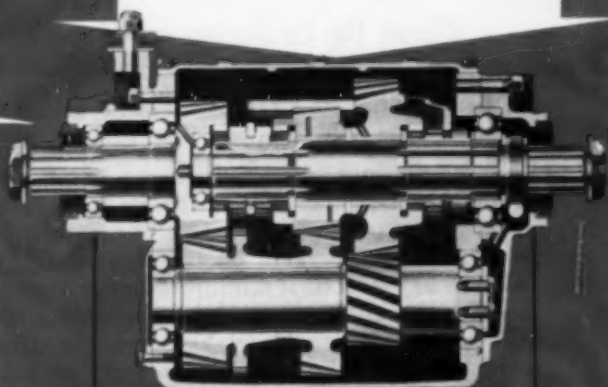


65 Series (Medium-Heavy-Duty)

MODEL	RATIOS		
	High	Medium	Low
3-A-65	.754	1.00	2.221
3-B-65	.804	1.00	1.239
3-C-65	.754	1.00	1.239
3-D-65	.804	1.00	2.221
3-E-65	.804	1.00	1.74
3-F-65	.754	1.00	1.74
3-G-65	1.00	1.32	2.221
3-H-65	1.00	1.32	1.74

92 Series (Heavy-Duty)

MODEL	RATIOS		
	High	Medium	Low
3-A-92	.75	1.00	2.09
3-B-92	.84	1.00	1.24
3-C-92	.75	1.00	2.64
3-D-92	.75	1.00	1.24
3-E-92	.84	1.00	2.09
3-F-92	.84	1.00	2.64
3-G-92	1.00	1.327	2.09
3-H-92	1.00	1.327	2.64



Model 3-A-92 • Weight - 350 lbs.

Now ...the most complete line of 3-speed AUXILIARY Transmissions

The Fuller Manufacturing Company now offers the most complete line of three-speed auxiliary transmissions . . . for transport, logging, construction, mining and crane carrier services . . . at lower prices than competitive units in a comparative capacity range.

The extremely rugged heavy-duty 92 Series has been completed by the addition of 5 new sets of gear ratios, Models 3-D-92 through 3-H-92. Four new sets of gear ratios, Models 3-E-65 through 3-H-65 have been added to the medium heavy-duty 65 Series.

Split Gears and GO

The expanded line of three-speed

auxiliary units includes splitting ratios, both underdrive and overdrive. With these splitting ratios, the engine can operate at maximum horsepower through a full range of vehicle speeds. Ideal for over-highway operation, the extra gears allow faster schedules, greater profits.

Deep Reductions

Deep reductions, in combination with splitting ratios, offer maximum flexibility both on and off-highway where the deep reduction is required for extreme grades and soft footing, and where splitting efficiency is required for traffic conditions.

Longer Equipment Life

With engines working in the most efficient torque and horse-power range, there is less lugging . . . less wear . . . and greater fuel economy. Result: lower maintenance costs, less downtime, longer engine and transmission life.



FULLER MANUFACTURING CO. Transmission Division • Kalamazoo, Mich.
Subsidiary, Eaton Manufacturing Company

Unit Drop Forge Div., Milwaukee 1, Wis. • Shaler Axle Co., Louisville, Ky. (Subsidiary) • Sales & Service, All Products, West. Dist. Branch, Oakland 6, Cal. and Southwest Dist. Office, Tulsa 3, Okla.



Patents Pending

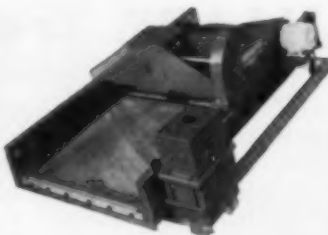
Clean Up to Twice as Much Fine Coal in Present Floor Area

By placing two identical coal washing decks in the space formerly required for one, the CONCENCO® "77" Table with its twin decks makes it possible to step up the capacity of your present floor area by as much as 100%, without any structural reinforcement of existing building. Because the floating suspension of the "77" so reduces impact to the supporting structure, when new housing facilities are required substantial savings may be made with lighter construction.

Mechanically, the twin decks are integrated for operation by a single head motion to duplicate single deck action and efficiency . . . while requiring less than 3 H. P. in operation. For full information, send for Bulletin 77.

FOR SCREENING ECONOMY

All New Model Leahy® screens utilize proven differential vibration that snaps oversize wedging particles loose 1600 times per minute. When dust is a problem, totally enclosed models are most effective. For damp screening, FlexElex® electric heating of the screen jacket insures full-time open mesh. For efficient wet screening CONCENCO® spray nozzle arrangements are your answer.



THE DEISTER ★
CONCENTRATOR
COMPANY

723 Glasgow Ave. • Fort Wayne, Ind., U.S.A.

CONCENCO
PRODUCTS

★ The ORIGINAL Deister Company • Inc. 1906

New Books (Continued)

maintenance of materials used in apparatus. There are 24 chapters with each having its own index. The book would be a valuable addition to any electrical engineer's or maintenance man's library. 383 pp. 5½x7½-in; plastic. \$2, Westinghouse Electric Corp., Pittsburgh, Pa.

Fuels and Power in Industry

Fuels and Power in Manufacturing Industries, by W. H. Voskuil compares the quantities and costs of the fuels used in manufacturing in 1947 and 1954, according to the Bureau of Census. Thermal values of each fuel are converted into Btu's and costs are computed in cents per million Btu's for each fuel. Consumption of electrical energy, quantities purchased from utilities, and quantities generated by industry in 1947 and 1954 are included. 25 pp. 6½x10-in; paper. Circular 259, Illinois State Geological Survey, Urbana, Ill.

Anthracite Gasification

Lurgi-Gasifier Tests of Pennsylvania Anthracite, by R. E. Morgan, J. W. Eckerd, J. Ratway and A. F. Baker describes experiments conducted by the USBM in a high-pressure oxygen-blown Lurgi gasifier in Germany. Although the tests showed it is technically feasible to gasify anthracite on a commercial scale, the report says development of an economic anthracite-gasification process will require considerable further research. R. I. 5420, Publications-Distribution Section, Bureau of Mines, 4800 Forbes Ave., Pittsburgh 13, Pa.

Precast-Concrete Roof Support

Using Precast Reinforced-Concrete Sets in the Pioneer Tunnel of Great Northern Railway's Cascade Tunnel, King County, Wash., by E. W. Parsons describes successful replacement of wooden timbers with concrete supports in a drainage and service tunnel. Although concrete sets cost about 50% more than wooden support, the reports notes that the permanence of the concrete units will more than offset the difference. I. C. 7858, Publications-Distribution Section, Bureau of Mines, 4800 Forbes Ave., Pittsburgh 13, Pa.

Permissible Equipment

Permissible Mine Equipment Approved During the Calendar Years 1953-56, by E. J. Gleim supplements Bulletin 543 and I. C. 7722 covering permissible equipment listed in 1953-54. The current list includes two complete mine-lighting systems as well as manufacturers of flame-resistant trailing cables and fire-resistant conveyor belts. I. C. 7840. 15¢, Superintendent of Documents, Government Printing Office, Washington 25, D. C.



Style GR, cylindrical insert



HR Style, 1 1/2" gage stop



JH for continuous miners



H/N recovery auger bit



G Style, straight shank



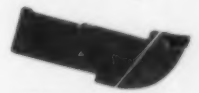
Style GH, notched shank



JC Colmel and Boring bit



GV, for Joy GV-6111 chain



KN Style, chisel-nose tip



HN Style, 1 1/2" gage stop



Style A straight shank



Style C for impurities



Style D for coal, potash, salt



Style E for Goodman Borers



Style CC, milled shank



L Style for Bowditch ML chains

CARMET OFFERS 25 STYLES OF MINING TOOLS

for every condition you have

Carmet carbide mining tools get high-tonnage production because they're precision made to meet specific mining operations. Hard, tough grades of carbide are induction brazed to high alloy, heat treated shanks in a way that insures maximum tool life. Cutter bits are designed for shortwall, longwall, universal machines and continuous miners of every make. Drill bits drill clean, straight holes at fastest speeds. Carmet distributors keep a complete line of Carmet Mining Tools in stock for prompt delivery. Carmet field engineers are always on call to help you solve tool problems and cut mining costs. Take advantage of their know-how now.

NEW CARMET MINING TOOL CATALOG NOW AVAILABLE FROM YOUR CARMET DISTRIBUTOR

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Offices: Buffalo, Rochester & Syracuse, N.Y.
Carbon Transfer & Supply Co., Helper, Utah
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WSW 7209

Plain Primacord Trunk Line. Is used also for shallow holes — wherever resistance to abrasion and cutting is not required. Textile covered, flexible, resilient, with a tacky non-slip surface. Tensile strength 125 lbs. — 1000 ft. spool weighs 18 lbs.

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The square knot is used only above ground, to lengthen a trunk line of Plain or Reinforced Primacord, or to tie in Primacord M & S Connectors. It must be drawn up tight.

P-4

DECEMBER, 1958

IVAN A. GIVEN, EDITOR

More Gas

CANADIAN GAS, from all appearances, is getting set to give U. S. coal producers, and oil companies as well, a much rougher time—unless curbed as a matter of public policy. Immense reserves are being proved up, but more important, public policy in Canada is crystallizing in favor of encouraging exports to the U. S. Among the recommendations of the Borden Commission in November was one favoring the adoption of lower prices for gas exports. Mexico also is entering the field.

The effects could be felt all over the U. S. Canadian gas in the Middle and Northwest

would permit diverting Louisiana and Texas gas to the East and South. In fact, it is quite likely that increased competition could be felt anywhere coal delivers at less than \$10 a ton. There are, of course, limits, but they are elastic enough to let in a lot more gas, provided public policy permits. One job for coal therefore continues to be that of pressing for the proper policy. The other, as always, is continued stress on cutting not only mine price but also mine-to-market transportation costs, plus research and development of new burning equipment, and the best in merchandising.

Servo Mining

COAL'S PROFIT PICTURE is naturally spotty, especially now, but is better than it has been at times past. One reason is the refusal to sacrifice prices that has characterized this particular depression. Another is the increasing effectiveness of the machine methods on which coal has lavished a big share of its investment money in past years.

So far, machines have required operators and these operators have had to be with the machines. The next big step—in underground mining, at least—will be largely or fully automated

miners controlled from remote points. This latter, of course, eliminates much of the roof-support cost and also the prime cause of accidents. Thus, it expands significantly the savings resulting from reduced labor.

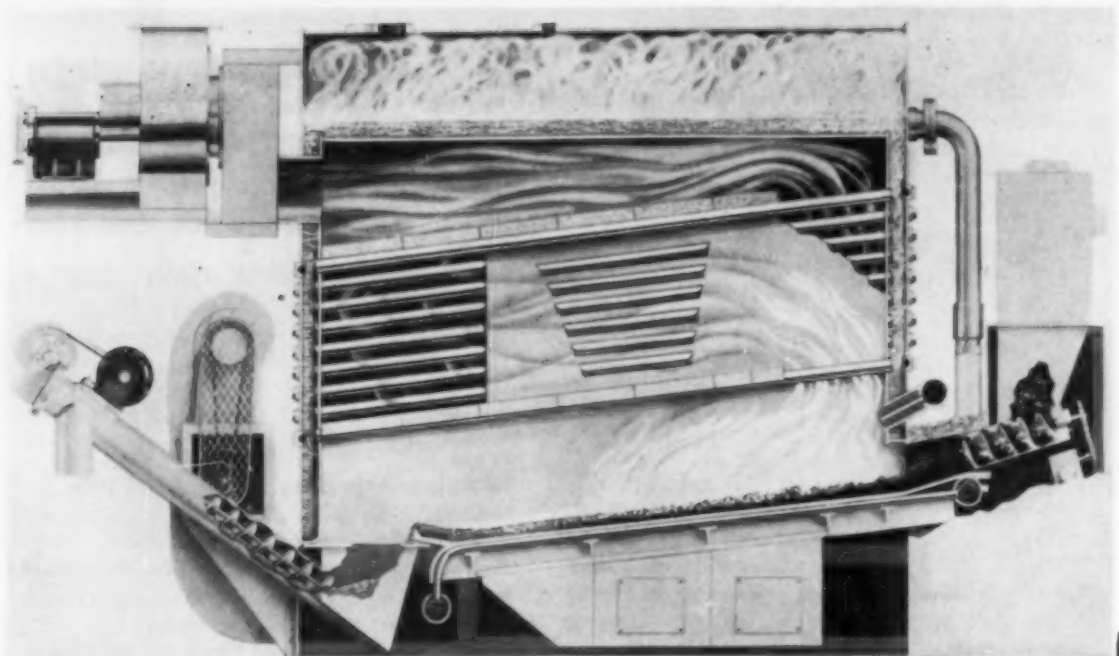
Recent developments will speed up the development of servo mining, so named for the motors and actuators that replace human muscles in controlling machine operation. The faster such development takes place the sooner the industry can begin to enjoy the undoubted cost advantages.

No Letup

ONE EXPLOSION of any type, whether resulting in injury or not, is one too many in a coal mine. The possible consequences of an ignition of gas or dust or both are major in both lives and property damage, as the two explosions in November—the first in 1958—vividly demonstrated once again.

The gas hazard in coal mines can add up to

hundreds of thousands of cubic feet per day, and dust to thousands and thousands of tons. Constant working under such conditions tends to result in unthinking tolerance, in turn leading to conditions and actions that can result in disaster. The answer still remains the best in ventilation, dust control and other protective measures, plus constant personal vigilance—without letup.



COMPACTNESS, peak combustion efficiency and completely automatic operation—plus economy of coal use—are features of Coal-Pak design (above). Features provide hard-hitting sales punch to beat stiff packaged-boiler competition.

Coal-Pak Ripe for Sales Growth

Coal's new packaged steam generator offers a concrete opportunity to recover losses and make new gains in the commercial market. Needed for maximum success: The massive effect of aggressive promotion by individual companies.

By W. A. Raleigh Jr.
Associate Editor, Coal Age

NOT YET SELLING LIKE HOT CAKES but certainly making a strong bid to develop new and recover old customers for bituminous in the commercial market about sums up 15 mo of merchandising experience and progress with the new Coal-Pak Automatic packaged-steam and hot-water generator.

Beefing up the bid are a successful field testing program, a nucleus of satisfied customers, and a growing list of prospects which gives promise of nationwide use in small industrial plants, commercial buildings and institutions. A full line of Coal-Pak units

is available for space heat, hot water or process steam.

Those close to the development consider that the Coal Pak offers a real opportunity to plug a serious competitive gap in bituminous coal's commercial market. In postwar years, the gap has been opened by severe competition from oil- and gas-fired packaged boilers. Many of coal's customers and prospects have swung to these boilers because they offered functional advantages of completely automatic operation, cleanliness, convenience and a minimum of maintenance.

Now, however, the Coal-Pak, within the range of its capacities, offers all the functional advantages of competitive packaged boilers plus the benefits of fuel savings from coal use.

How well the Coal-Pak manages to

close the competitive gap in the years ahead will be largely determined by the force and breadth of industry-wide action in promoting its use. An outstanding start has been made in this direction through the cooperative efforts of Bituminous Coal Research and Bituminous Coal Institute working in conjunction with the International Boiler Works, East Stroudsburg, Pa. BCR, which developed the Coal-Pak, conducts field testing and handles laboratory modifications to equipment. BCI develops leads and prospects and supplies engineering services. IBW manufactures the equipment, and, through a nationwide organization, contributes sales promotion and closes sales.

The following progress report highlights the principal developments contributing to Coal-Pak's "outstanding start."

Development

From Lab to Market—The amount of time required to plan, develop and market a new product or process varies with the complexity of tech-

nical and economic problems involved. At least 10 yr used to be the norm for major projects with numerous complex problems. In recent years, however, with increased nationwide emphasis on industrial research, average lab-to-market time for major products has been cut to about 7 yr. BCR and the bituminous industry can justly boast of a 5½-yr span to get the Coal-Pak from drawing boards through a year of successful commercial field testing.

This achievement takes on added significance in reviewing the number and magnitude of problems involved. The Coal-Pak project called for designing and developing:

1. A boiler-burner combination that could burn a variety of bituminous coals efficiently and accommodate varying loads.

2. An automatic ash-removal mechanism with a refuse conveyor to storage bin or other disposal outlet.

3. A control system that would automatically coordinate fan, stoker and ash-removal operations within safety limits appropriate to wide and sudden load changes.

4. A total product that would offer maximum compactness, permit factory assembly and testing, and be economically competitive with oil- and gas-fired packaged-steam generators.

"Early in the course of the project," Paul O. Kock, BCR project engineer states, "it was determined that boilers, stokers and controls available on the market were inadequate because they did not enable the degree of compactness that was required . . ." Thus, to fill the bill of specifications, it became "necessary to develop completely new components for combination into package design."

In spite of tough problems, a chronology of Coal-Pak history shows that its development started in mid-1953. Some 3½ yr later, on Dec. 12, 1956, the first completely successful model was put into operation in BCR's Columbus (Ohio) laboratories. During following months a series of lab tests established performance standards for burning coals from various seams. And, in October, 1957, the Coal-Pak made its commercial debut with the installation of one unit at the Walter

J. Engel Nursery, Columbus. In January, 1958, three more units were installed at Otterbein College, Westerville, Ohio.

Field Performance—Queried by *Coal Age* on the performance of the first four field units, BCR's Director of Research, James R. Garvey, commented as follows:

"The four units which were in service [this] last year, one at the Engel Nursery, Columbus, Ohio, and three at Otterbein College, Westerville, Ohio, gave satisfactory performance. As is the case with any newly developed product, some mechanical changes were necessary after the installations were completed. These changes have been accomplished, and it is expected that the ultimate in automatic operation with a coal-fired packaged steam generator will be obtained this year. The unit at the Engel Nursery was in operation from mid-December, while the three at the college were in service from mid-February. Both customers are enthusiastic about the results obtained."

Morgan Hebbard, IBW Sales Manager, describes the Coal-Pak as "the first thoroughly proven, fully automatic packaged unit with combustion controls, automatic coal feed and ash-removal system, for burning low-cost bituminous coal cleanly and efficiently." Two complete series of units are available: one series for low-pressure heating, the other for high-pressure hot water or steam. In each series, there are six sizes ranging from 71.6 up to 300 hp or 10,000 lb of steam per hr. "All are built in strict accordance with the latest applicable ASME code and job-site requirements as to safety, materials and fabricating methods."

Sales Progress

From a greenhouse and a college, outlets for Coal-Paks have grown to also include a high school, a church, a seminary, and office and service buildings of industrial plants. In all, 13 unit orders were placed during Coal-Pak's first year on the market and three more are reported under active consideration.

Furthermore, as of July, 1958, BCI counted 75 to 100 prospects who had shown "more than a passing interest." Prospects are located in all 14 BCI

districts and run the gamut of commercial outlets. Included are quite a few schools where sales could result in multiple installations.

Unit orders placed during Coal-Pak's first year on the market consisted of the following:

Walter J. Engel, Inc., wholesale florists, Columbus, Ohio—One 200-hp low-pressure steam unit to heat greenhouses.

Otterbein College, Westerville, Ohio—Three 200-hp units: one low-pressure steam and two hot water to supply heat and hot water for college buildings.

Union Local School Board of Education, Morristown, Ohio (near St. Clairsville)—Two 71-hp hot water units to heat and ventilate a new high school.

St. Clare of Montefalco Catholic Church, Chicago, Ill.—One 100-hp low-pressure steam unit to supply added heating capacity for church and convent buildings.

M. A. Hanna Co., iron-ore beneficiation plant, Groveland, Mich.—Three 300-hp low-pressure steam units to heat offices and shops.

Saint Francis Seminary, Mt. Healthy, Ohio (near Cincinnati)—Two 71-hp low-pressure steam units to supply seminary heating needs.

Kaiser Steel Corp., Raton, N. M.—One 200-hp low-pressure steam unit to heat new office and service buildings.

Maximum coal rates (using 13,000-Btu-per-ton coal) for the preceding units are: 71 hp, 240 lb per hr; 100-hp, 343 lb per hr; 200 hp, 687 lb per hr; 300-hp, 1,030 lb per hr.

Under active consideration are the following installations:

Rochester & Pittsburgh Coal Co., Glenville, W. Va.—One 200-hp low-pressure steam unit to heat a cleaning plant, mine office and service buildings.

Old Ben Coal Corp., Mine No. 21, Sesser, Ill.—One 100-hp hot water unit for process hot water and to heat all buildings except the cleaning plant.

National Coal Association, Washington, D. C.—Two 71-hp low-pressure steam units to heat planned new office building.

Coal-Pak promoters are particularly happy to note that sales so far are giving them a constantly improving spread both by type of user and by



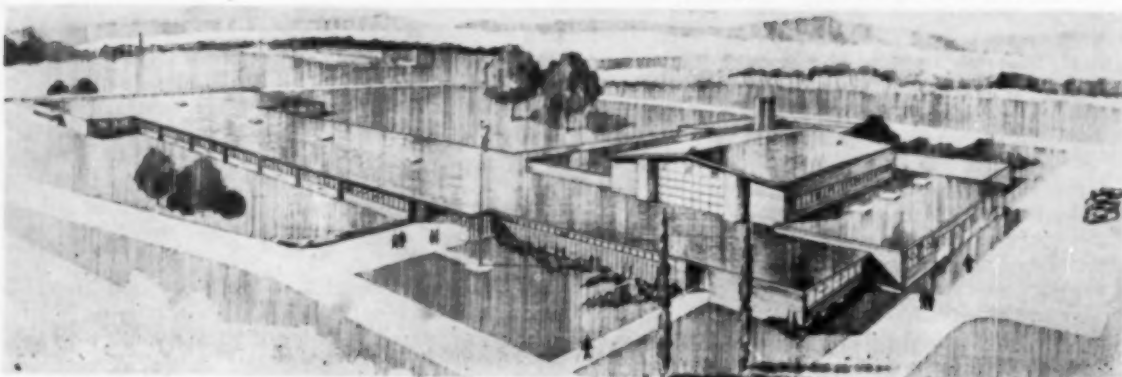
Constantly improving spread of demonstration plants may lead to "snowballing effect" on Coal-Pak sales . . .



BY TYPE OF OUTLET, the spread has grown from a greenhouse and college to also include a high school, a church, a seminary, and office and service buildings of industrial plants . . .

BY LOCATION, the spread has grown from Ohio to also include Michigan, Illinois and New Mexico, with prospects reported in all 14 districts of BCI marketing territory . . .

TYPICAL OUTLETS include the M. A. Hanna Co.'s iron ore beneficiary plant, Croveland, Mich. (above); the St. Clare of Montefalco Church, Chicago, Ill. (left); and Morristown, Ohio's new million-dollar high school (below).



geographical location. Here's why. They see a possible "snowballing effect" for sales in being able to demonstrate plants in action and, they add, "There's nothing like satisfied customers to undergird a sales pitch and swing doubtful prospects to coal."

Great hopes are expressed for the Coal-Pak in 1959. As one effort to get sales off to a good start, IBW, BCI and BCR jointly sponsored an active display of the new steam generator at the Power Show, New York City, during the week of Dec. 1, 1958.

Another vital sales aid will be *Guide Specifications (GS-3)* published by BCI in October, 1958. The guide specs give consulting engineers, architects, etc., complete data and drawings on three typical installations. Included are plant layouts for low-pressure steam heating, hot-water heating and process steam.

Merchandising The Story

BCI Mission—Getting the Coal-Pak off the ground commercially is one thing. Pushing toward maximum sales development is another. No groups realize this more keenly than BCI's administrative-, field- and advisory-committee staffs which carry the brunt of taking the Coal-Pak story to all regions of coal-marketing territory.

BCI men take readily to merchandising the Coal-Pak story because it gives them another opportunity to fulfill their mission. A *Coal Age* feature (January, 1957, p 54) defined that mission as an industry-wide effort to:

1. Minimize heavy losses to competitive fuels.
2. Get a bigger share of the new business that is constantly developing.
3. Convert gas- and oil-burning plants to coal.

Coal-Pak Target—In the Coal-Pak, BCI men see the answer to meeting and beating severe competition from oil- and gas-fired packaged boilers in the commercial and small-industrial-plant market. The severity of competition shows up in recent BCI experience. During the 8 mo period, October 31, 1957 to July 1, 1958, BCI recorded the following gains and losses for coal in tonnage and number of plants:

	Coal or Coal- Equivalent Tons	Number of Plants
Gained.....	4,876,430	...
Recovered.....	100,000	...
Retained.....	1,500,000	...
TOTAL.....	6,476,430	523
Lost to oil and gas	1,766,720	454
NET GAIN.....	4,709,710	69

Tonnage-wise, the net gain for coal was highly satisfactory during the period shown above. At the same time, however, the net gain in number of plants was much less favorable. Thus, in reconciling the disparity in tonnage- and plant-net gains, it is quite obvious (1) that coal is king-pin in large plants served by standard-size water-tube boilers, and (2) that oil and gas still hold a firm grip on the small-plant or packaged-boiler market. And here is the Coal-Pak's competitive target. Its function is to break this grip and bring small boiler plants back into the coal camp.

Sales Approach—In fighting competitive claims, BCI men merchandise the Coal-Pak as a better engineered product which offers not only all the operational advantages of packaged-oil and gas boilers but also real opportunities for annual fuel-cost savings.

Carroll Hardy, managing director, BCI, and Charles H. Marks, manager, engineering development, stress the Coal-Pak's superior combustion efficiency. "Unheard of before," they say, "is its efficiency rating of 80 to 85%." Previous comparable-size coal-burning boilers have had an efficiency rating of 70 to 72%; modern packaged oil-boilers claim a questionable 80%.

Coal-Pak's high combustion efficiency is primarily due to:

1. The unique combination of a five-pass firebox-type watertube boiler with a water-cooled pulsating-grate stoker.
2. A control mechanism which automatically and accurately regulates the proportion of combustion air to the fuel-feeding rate throughout the entire load range.

Five-pass boiler design is a key combustion efficiency feature since it provides five instead of the usual two or three tubes for heat transfer.

Opportunities for annual fuel-cost savings are a powerful selling point in the sales approach to prospects. At the present time automatic controls

and the automatic ash-removal system put Coal-Pak's initial cost somewhat higher than comparable packaged oil boilers. On an average, however, the added initial cost can be written off through 4 or 5 yr of savings from burning coal.

Thus, with a minimum 20-yr life span for the Coal-Pak users can usually figure on at least 15 yr of substantial savings in the annual fuel bill. Since annual fuel savings in the commercial market are more critically surveyed than in the residential market, this factor carries much weight in selling prospects. To a business operation it can mean reduced production costs; to a school operation it can mean reduced taxes for the community.

Fuel-cost saving opportunities bear out in Coal-Pak installations noted previously. At its iron-ore beneficiation plant, Groveland, Mich., for example, the M. A. Hanna Co. expects to save \$27,000 annually in fuel costs to heat offices and shops; at its new high school, Morristown, Ohio, the Union Local School Board of Education looks for savings of \$3,000 a year.

Looking Ahead: A Concrete Opportunity

No one has yet come up with predictions about Coal-Pak's potential to retain old and capture new tonnage. For one thing, it is much too early in the merchandising program; for another, market data in the commercial market is not detailed enough for sound forecasts.

But the industry can be sure that its new packaged steam generator has got off to an outstanding start. In the small boiler field the industry can also be sure that the Coal-Pak offers a concrete opportunity to turn back the tide of competitive fuel gains which have taken away millions of tons of coal business in postwar years.

Up to this point, BCR and BCI, working closely with the International Boiler Works have carried the ball for the Coal-Pak. As successful as the efforts of industry organizations may be, however, they never substitute for the massive effect of sales promotion by individual producing companies. From here on out, therefore, the extent to which individual companies hop on the Coal-Pak bandwagon could be the biggest single factor in determining its long-range success.



STRIPPING OPERATIONS are concentrated in the Five Block and Stockton seams. Note positions of other seams that have been stripped.

The Boone County Coal Corp., with properties comprising a single contiguous area of approximately 23,000 acres and estimated reserves of more than 150 million tons of recoverable coal, is a wholly-owned subsidiary of the Lehigh Coal & Navigation Co., Bethlehem, Pa. The parent firm, known in the industry as "The Old Company," is the Nation's oldest producer and shipper of coal. Its beginnings date back to 1793.

Founded in 1911 by Philadelphia interests, Boone County Coal was controlled and operated by that ownership until 1957, when it was acquired by Lehigh Coal & Navigation. Even now, though an LC&N subsidiary, it is a largely autonomous company with headquarters at Sharples, W. Va. R. E. Sächs is president. Mr. Sächs is also president of the Lehigh-Boone Bituminous Corp., of Bethlehem, which markets the Boone County output.

Located in the heart of the bituminous coal region of West Virginia, Boone County's property lies about 50 mi south of Charleston. The larger portion of the holdings is in Logan County but they also extend into Boone. The company is served by the Chesapeake & Ohio Ry. The operation consists of deep, strip and high-wall mines and a large, modern preparation plant. At present, the deep-mine operations are largely in the Chilton seam while the strip operations are primarily in the Five-Block and Stockton seams.

How Boone County Gets Results

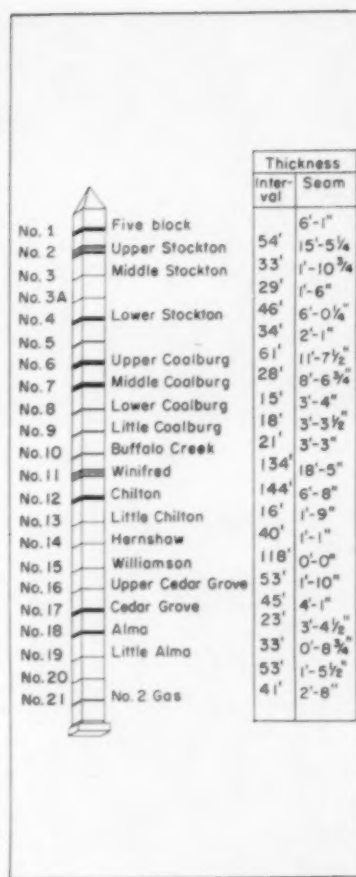


Flexibility in methods to cope with unusual seam conditions, and coordination between deep and strip mining yields record 1,308,198 tons for processing in modern preparation facilities.

PREPARATION PLANT processes deep-mined and strip coal separately. Belt conveyor (left) feeds coal to the plant from a 1,200-ton storage bin and covered conveyor (extreme right) supplies the plant with strip coal. Belt conveyor in background carries refuse to disposal area.



PROPERTIES of the Boone County Coal Corp. aggregate 23,000 acres containing an estimated 150 million tons, much of it in the highly regarded Chilton seam.



DIFFERENT COAL SEAMS on Boone County Coal's property are shown above.

In Mining and Preparation

By Daniel Jackson Jr.
Assistant Editor, *Coal Age*

INGENUITY IN PLANNING AND FLEXIBILITY in mining methods are the basic approaches to combined deep and strip mining at properties of the Boone County Coal Corp., Sharples, W. Va. An all-belt deep mine is in a seam which contains an average uphill grade of 9%, with some local areas having as much as 25. A strip mine is unusual in that it can mine one or a combination of seven seams. Present stripping is in two seams located near the tops of the mountains. Future plans include setting up a series of punch mines along the highwall to increase recov-

ery from stripped seams near the tops of the mountains.

Boone County Coal was purchased by the Lehigh Coal & Navigation Co., Bethlehem, Pa., in 1957. Although a wholly-owned subsidiary of LC&N, Boone County Coal operates as a largely autonomous unit. Since its purchase, it has embarked on an expansion program designed to increase production and produce a quality product by utilizing efficient, economical mining methods and employing the latest in preparation techniques and equipment. As a result of this program, the 1957 output (1,308,198 tons) exceeded a million tons—a first in the company's history.

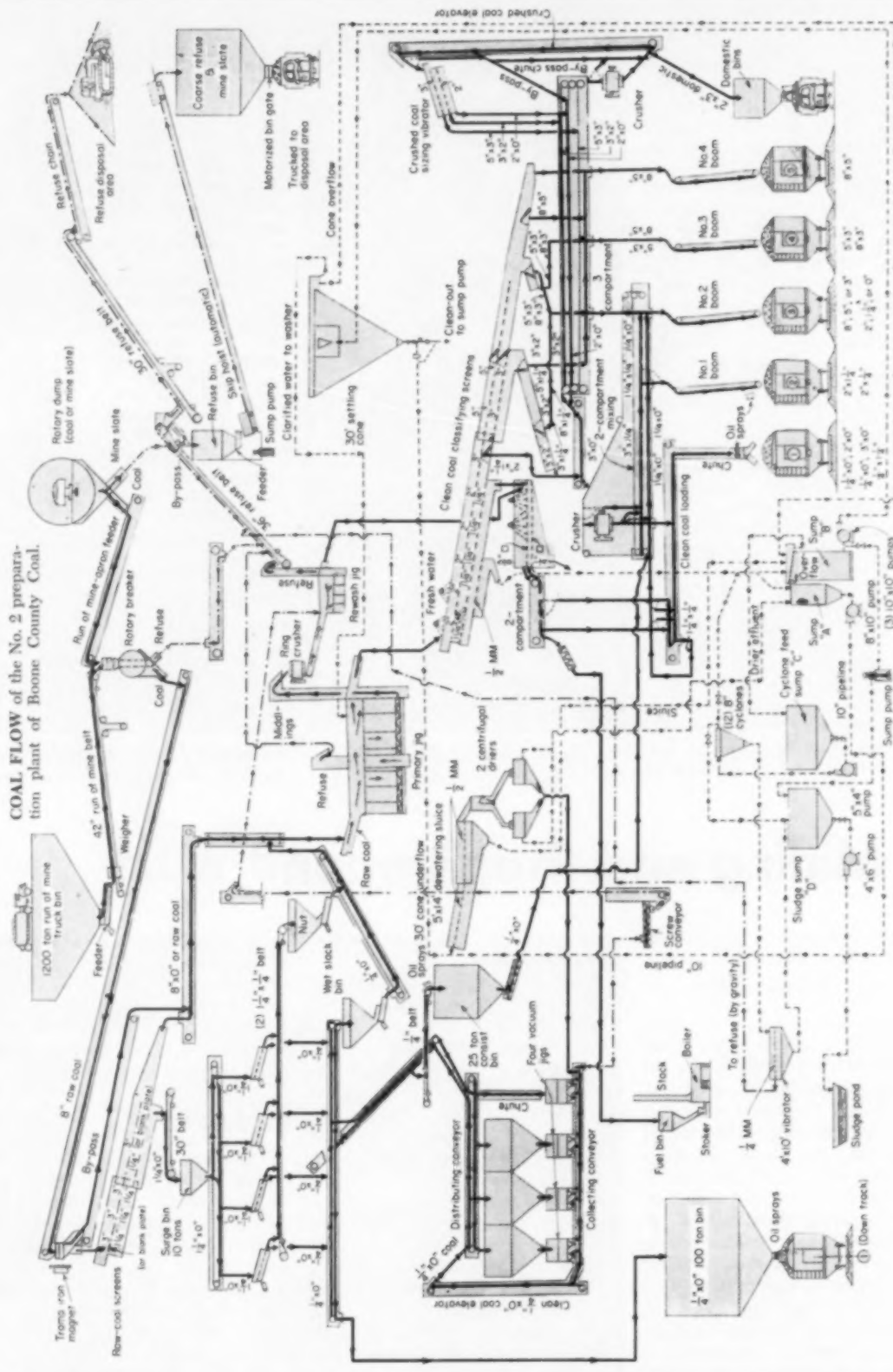
The property comprises a total of 23,000 acres containing 12 minable seams of coal and an estimated re-

serve of 150 million tons. These assets, plus favorable geological characteristics, have contributed to the success of the 47-yr-old operation which features versatility through a combination of deep and strip mining of the available seams.

Deep Mining

The company's recently opened No. 2B mine is in an acreage of the Chilton seam that was written off the books some 20 yr ago as nonminable. Adverse grades made operation difficult with the equipment then available. However, the development and improvement of belt conveyors and other mining equipment enables the company to mine this seam economically today. The over-all problem,

COAL FLOW of the No. 2 preparation plant of Boone County Coal.



however, was not solved by modern equipment alone. Mining methods best suited to these rather unusual conditions were developed and put into practice to attain a production performance of 40 tons per faceman.

The No. 2B mine was designed to replace the tonnage of other mines which are reaching the end of their productive life. It is located approximately 2 mi from the preparation plant and other deep mine operations.

The seam mined is at water-table level. Thickness is 60 in, including a parting about midway in the seam. Parting thickness ranges up to 8 in—or more in some areas. The Chilton top is laminated slate and shale, with sandstone in some sections of the mine. Although bad top occurs in local areas, conditions generally are good.

The mains consist of six headings 18 to 20 ft wide on 60-ft centers. Cross headings are turned on an angle of 60 deg with headings on 70-ft centers. This practice, incidentally, facilitates maneuvering equipment, especially shuttle cars, by permitting it to ascend grades gradually rather than head on and preventing travel parallel to the grade in crosscuts. Thus, haulage is faster and the job of positioning equipment and manipulating controls is eased. The unavoidable equipment abuse resulting from operating under these conditions is eliminated. Normally one traction motor is used more often than the other on grades and this tends to shorten motor life considerably.

Main headings have been driven approximately 3,000 ft in by the outcrop. The seam has maintained an average uphill grade of 9% with local areas having as much as 25. According to data collected through a series of core-drill tests and outcrop surveys, this block of coal is expected to level off when headings reach approximately 3,500 ft. At present, all indications favor a leveling off at this point.

Another important characteristic of this seam, which must be considered in the over-all mining plan, is that no more than 70% of the coal can be mined. To remove more than this would result in seam rides and coal losses. Because of this, the mining plan is rather regular with main and panel headings following a similar pattern. The one exception is that the number of panel headings is eight



TOP MANAGEMENT—R. F. Wesner, vice president operations, and William E. Byers, acting general superintendent.



SURFACE MINE SUPERINTENDENT, W. J. Chambers, is in charge of stripping.



GOING OVER DAILY COST SHEET is Russ Ward, deep mine superintendent.

when conditions permit, while mains are six. This method has proved more successful in promoting a higher output per section than any other yet employed at 2B mine.

When the coal levels off, the practice of angling crossheadings (and crosscuts) will be discontinued in favor of turning them 90 deg.

Section Equipment and Spare Units—Standard equipment for each of the four sections comprises the following:

- 2 Joy Super 14 BU loading machines.
 - 2 Joy 10 SC shuttle cars with a capacity of 4 tons each.
 - 2 Joy 11 RU cutting machines with 9-ft bars.
 - 2 Joy CD-25 rubber-tired coal drills.
 - 2 Fletcher Hydro-Slide roof-bolters with M-S-A dust collectors.
 - 1 Goodman 97-HC 36-in rope belt.
- As noted in this list, each section

is equipped with a spare unit of each type of equipment. However, the types of machines vary somewhat: i.e., 10 RU cutters instead of 11 RU's; 6 SC shuttle cars for 10 SC's; Super 14 BU loaders for standard 14 BU's; Joy RBD-15 roof-bolters for Fletcher Hydro-Slides; Joy CD-22 for CD-25's; and Joy 30-in rope belts for Goodman rope belts.

This extra equipment became available as other mines worked out. Rather than set it aside, management chose to fortify each section with spare units. Production is benefitted by the continuous availability of equipment. And when a machine needs repair it is set aside and its mate takes over. Spare equipment is kept as close to the working face as possible to minimize change-out time.

Equipment is repaired and serviced by a mechanic stationed on each section. His duties, among others, are to



COVERED BELT CONVEYOR (foreground) carries strip-mined coal from the storage bin at the foot of a 400-ft chute from the dump to the preparation plant.



NEW VERTICAL DRILL on tractor is especially adaptable to rough terrain.



COAL FROM 2B MINE is brought outside by a 36-in belt and stored in bins.



OVERBURDEN shovel with 4½-yd capacity removes the second bench of spoil.



TRUCKS UNLOAD at the dumping station on the same level as the seams being stripped and 1½ mi from the pits. A 400-ft chute carries it to a 200-ton bin.

keep spare equipment in readiness to go into operation at a moment's notice and to see that all equipment is properly lubricated. Although more equipment must be maintained and serviced, the mechanic has access to all equipment and is able to go over each unit by changing units at convenient times so that it will not interfere with production.

Production Crews—A standard production crew is made up of 10 men, as follows:

- Loading-machine operator and helper.

- Two shuttle-car operators.

- Cutting-machine operator.

- Roof-bolter.

- Coal driller and shot-fireman.

- Mechanic.

- Supervisor.

Roof Support—As soon as the loading machine cleans up a place, the roof-bolter moves in, sets safety timbers and bolts the top. The roof-support plan requires that bolts be installed on 4-ft centers through 3x10 x24-in half-headers and that sufficient safety posts be set for face protection. One man performs this job and yet maintains a balanced cycle.

Controls for the Fletcher roof-bolting machine have been changed so that the operator can work more freely and be in a safer position. This change was necessary due to seam conditions. It consisted of remounting the controls in a permanent position on the operator's side instead of having them in front of and moving with the Hydro-Slide.



MAINTENANCE of strip-mine equipment is facilitated by a portable welding unit. A systematic approach and assignment of responsibility and authority are keys.

Cutting, Drilling and Shooting—After the place is made safe by the roof-bolter, the machine crew cuts the coal on the bottom. When the parting in the seam thickens to the point where it causes trouble in shooting and loading, the machine crew double-cuts each place.

After the cutter crew moves to the next place, the driller and shotfirer prepare the coal for loading. This stage includes drilling 10 holes and shooting the coal.

After holes are drilled, the shotfirer loads the holes with Airdox tubes which are charged at 11,000 psi. The tubes are 8 ft long and 3 in in diameter.

Air is supplied by three compressors on the surface. It is transmitted to sections through a ½-in pipe. Each line on the section is equipped with quick-break couplings and a 15-ft hose.

Cost of blasting the coal with Airdox is approximately 6¢ per ton. This figure, however, varies and is controlled by the monthly output. The amount of time the compressors operate, total power consumed and the total tonnage are the controlling factors. Reduced cost, plus a better lump product, elimination of smoke and added safety were the reasons management chose Airdox over other breaking methods.

Section Ventilation—A new type of ventilation-control material (M'ne Ventilation Systems, Inc., Madison, W. Va.) is being tested in 2B Mine. It consists of vinyl plastic equipped

with grommets for hanging on nails or hooks. The material is employed for temporary stoppings, check curtains and line brattices. Mine management has found that use of the material results in more air at the face, while labor and material costs are reduced. Curtains and stoppings can be installed in ½ to 1 hr and the material can be used indefinitely.

Supplies and Mantrips—With no track or locomotives available to get supplies and men to the working sections—belts are not used for this purpose—a heading next to and parallel to the belt heading was designed to serve as the supply and mantrip haulway. Shuttle cars and a converted jeep equipped with a trailer-hitch are used to transport supplies and men to and from the sections. This equipment utilizes the inverted trolley system. Among other results, equipment using the system cannot be diverted and thus is available when and where needed continuously.

Removable ramps have been constructed at each panel entry for sections located on the opposite side of the main haulage belt. Consequently, supply shuttle cars do not have to be unloaded and reloaded to supply these sections.

Intermediate and Main Haulage System—"Mine haulage at No. 2B mine would be a near impossibility by any method other than belt conveyors," notes Russ Ward, mine superintendent. The all-belt mine has a total of 3,600 ft of 36-in mainline belt in operation, including 2,750 ft of

Management Team

R. F. Wesner, Vice President Operations
William E. Byers, Acting General Superintendent
Russ Ward, Mine Superintendent
W. J. Chambers, Surface Mining Superintendent
Roy Garhart, Chief Maintenance Foreman
H. B. White, Chief Preparation Plant Foreman
Harry B. Gloss, Purchasing Agent
E. L. Moore, Assistant Controller

Jeffrey rigid-frame belt conveyor and 850 ft of Goodman rope belt, which will be extended to a maximum of 2,500 ft as headings advance. Panel or intermediate haulage conveyors consist of 2,000 ft of 30-in Joy rope belt and 1,500 ft of 36-in Goodman rope belt.

Coal is discharged from shuttle cars onto the intermediate belt which in turn discharges to the mainline belt. Chutes are installed at each discharge point so that coal will load onto the main belt in the direction of travel. These chutes reduce spillage at transfer points and place the coal on the belt uniformly.

One drive unit of the main haulage belt is equipped with dynamic braking facilities to keep the loaded belt from drifting after power is shut off. The 9% grade, however, is in favor of the load and, therefore, less power is consumed in conveying the coal to the outside.

There are four loading stations along the main haulage belt and since all sections frequently load simultaneously the belt would be overloaded at times. This difficulty was remedied by Roy Gayhart, chief maintenance foreman, who designed a control that adjusts the speed of the intermediate belts to the condition of the main belt—loaded, partly loaded or empty (see operating ideas section 7 this issue).

The intermediate belts for the first two sections were equipped with this control. It was not necessary to install controls on the other belts, since the main belt could take care of all coal discharging at full speed from these sections.

Speed of the belts is controlled by solenoid-operated contactors which add or cut out resistance in the motor circuit depending on the load on the belt. It employs a shuttle-car accelerating switch which is attached to a shaft equipped with a roller. The roller is positioned in the center of

Form B. C. 5548 P. P. 22049

BOONE COUNTY COAL CORPORATION
REQUISITION ON WAREHOUSE

Mine No. _____ Req. No. _____

Equipment _____ Section No. _____ Date _____

Quantity	Part No.	Material	Cost	Charge

Foreman _____ Approved _____ Filled _____ Received _____

ARTICLE			CARGO NO.			BIN NO.			FILE					
ORDERED			RECEIVED			DISBURSED			ON HAND					
DATE	ORDER NO.	UNITS	ORDER NO.	DATE	UNITS	AMOUNT	DATE	UNITS	CHARGED TO	OBSO. LETE	SUR. PLUS	PMT. INV.	UNITS	STD. PRICE

USED PER MONTH	UNIT	WEIGHT	MAX	MIN	STANDARD ORDER	ORDERING POINT	USED ON:
DESCRIPTION							

UN PUR. CODE NO. _____

ARTICLE _____ CARGO NO. _____ BIN NO. _____ FILE _____

SUPPLY SYSTEM requires only two forms (above), simplifying inventory and minimizing clerical work.

and under the belt so that the load on the belt at the time it passes a transfer station depresses or releases the roller, thus controlling the speed of the belt. The control provides three speeds but never completely stops the belt.

Storage and Truck Haulage—The main haulage belt discharges into two 250-ton storage bins on the surface. A transfer chute is installed at this point and is designed to alternate loading between bins or to load into both simultaneously.

As noted previously, 2B mine is approximately 2 mi from the preparation plant. Facilities for storing and hauling coal to the plant, in addition to the 250-ton bins, include 35-ton Dart and Mack tractor-trailer trucks. The storage bin at the preparation plant has a capacity of 1,200 tons.

Trucks are loaded in 1 min and make a round trip in 15, including unloading at the plant.

The haulage road, 50% of which was built on an old railroad bed, resembles a super highway. Although not paved, the road is covered with river gravel and is graded daily to keep it in condition for high-speed haulage and also to reduce truck

maintenance. Haulage is contracted to the Bunch Construction Co., with road maintenance by the coal company.

Strip Mining

The strip mine operation at Boone County Coal adds an average of 1,100 tons to the company's daily output. Present stripping is in the Five Block and Stockton seams which are located near the tops of the mountains.

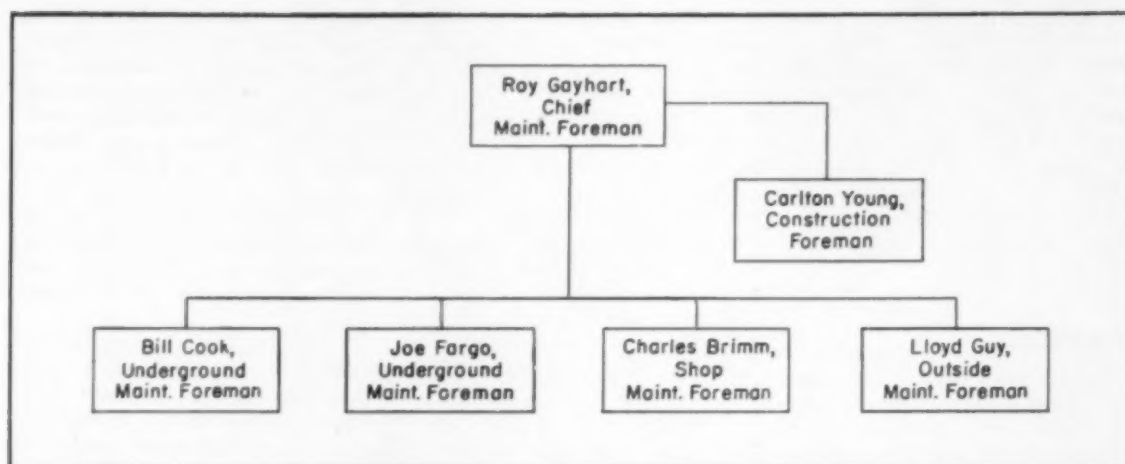
The company began stripping coal 3 yr ago in the Chilton seam. Since then, four other seams have been tapped but none completely stripped: i.e., the Buffalo Creek and Coalburg, and the Five Block and Stockton seams presently being operated. Life expectancy of the strip operation is approximately 20 yr. The Buffalo Creek, Stockton and Five Block are virgin seams.

Cover over the Five Block ranges from 0 to 150 ft. However, it is not uncommon to uncover complete islands or ridgetops with bulldozers and an occasional charge of dynamite to "pop" small areas of stubborn sandstone. The interval between the Five Block and Stockton seams ranges up

to 54 ft, with the Stockton below the Five Block. This interval is irregular and at times is as little as 15 to 18 in. Height of the Five Block is 6 ft and of the Stockton 15 ft. Since the Stockton occurs in four distinct benches with postings between, it occupies a total interval of 25 ft. Highwalls average 60 to 100 ft.

Stripping Equipment—The main unit employed in recovering coal is a Lima 2400 high-front shovel with a 4½-yd capacity. It works in cover averaging 90 ft. Other excavating units include a 3½-yd Lima 1201 shovel which is used to remove overburden and load coal, and a 1-yd Lorain 50K shovel used to strip and load small pockets. In addition to the shovels the equipment includes one D8, one D9 Caterpillar and one TD24 International tractor. Drilling equipment includes a new tractor-mounted Robbins 9-in vertical drill, a McCarthy 6-in vertical drill, a McCarthy 6-in horizontal drill. Three 35-ton Mack trucks are used to haul coal from the pit to the dumping station. Haulage is contracted to the Bunch Construction Co.

Overburden Preparation and Removal—Overburden over the Five



MAINTENANCE RESPONSIBILITIES at Boone County Coal are shared by supervisors to facilitate efficient machine care.

Block and Stockton seams consists primarily of very abrasive shale and sandstone. The interval between seams varies considerably. For example, one area has as little as 15 in of hard shale separating the Five Block from a 30-in split of the Stockton seam and below this 2 ft of shale separates this split from a 6-ft-thick split of the same seam.

The main stripping operation uses a tractor-mounted Robbins 9-in vertical drill to sink blastholes. Due to the steepness of the mountainside and hardness of the overburden, drilling and removing overburden is performed by the bench method.

Normal practice is to have a bulldozer make a roadway around the mountain for the vertical drill. The drill sinks two rows of holes on 18-ft centers. Back holes in present stripping are 35 ft deep and front holes 20. These holes are then charged and shot. The resulting overburden is removed by a bulldozer and shovel.

When the first bench is cleared the drill sinks three rows of holes on 18-ft centers 35 ft deep. This second pass exposes the coal in the present location. In thicker overburden, say 90 ft, the bench depths would be 45 ft, as an example.

Drill holes for each bench are charged with 250 lb of ammonium-nitrate and fuel-oil mixture and 25 lb of dynamite. Primacord and I7-MS delays are used in each hole.

During the winter months when waterproofing the blasting agent is necessary the company purchases premixed ammonium nitrate packaged in polyethylene bags from Nitrox Products Co., Charleston, W. Va.



PROCESSED COAL prepared to customers' specifications ready for shipment.

The fuel oil in these bags is dyed red to indicate that the ammonium nitrate is completely saturated. In the summer months, the company mixes its own blasting agent.

With the purchase of the new Robbins drill and the change to ammonium nitrate and fuel oil, William J. Chambers, surface mining superintendent, states that: "Overburden preparation, i.e., drilling, loading holes and cost of the new blasting agent, has been reduced to that of the powder cost alone."

Cutting overburden preparation cost is not the only benefit received from these changes. Digging is easier due to better fragmentation which re-

duces wear and tear on stripping units.

Removing overburden by the bench method enables the stripping units to advance more rapidly. Also, the equipment is not worked as hard when it removes two 35-ft sections of overburden as in removing one 80-ft section.

Loading and Hauling—Coal is loaded from the solid into 35-ton Mack trucks. These trucks haul coal to an unloading chute 1½ mi from the present strip pits and on the same level as the seams being mined. The haulage distance will not increase to more than a maximum of 2 mi in the next 2 to 3 yr.

Until recently coal was hauled down the mountain to a storage bin located above the preparation plant. Coal then was fed to the preparation plant by a feeder and belt conveyor. Now coal is hauled to a point above the storage bin and discharged into a 400-ft chute which directs it to the feeder and belt conveyor.

This change has reduced haulage cost 10¢ per ton.

Preparation

Boone County Coal's No. 2 preparation plant is geared to turn out 400 tph of clean coal. Design and construction of the plant were handled by McNally Pittsburg.

Coal from the No. 2B mine is stored in a 1,200-ton bin and surface coal in a 200-ton bin. Deep-mined and surface coal are prepared separately.

All ROM coal is fed to a McNally rotary breaker. The 8x0 from the breaker goes to a raw-coal conveyor which in turn feeds onto a scraper conveyor ahead of a raw-coal shaker. Refuse goes to the disposal area via a refuse conveyor.

The plant includes facilities for dry cleaning ¼x0 but at present the entire 8x0 ROM is wet washed in a Type 524 McNally-Norton 2-compartment 6-cell jig. Refuse from the primary end goes to a 36-in refuse belt. This belt can carry the refuse to the disposal area or to a refuse bin from which an automatic skip hoist moves it to a large slate bin for truck disposal. Clean coal from the primary washer goes to the classifying screens.

Middlings from the washer are picked up by an elevator which transports them to a crusher for reduction to 1¼x0. They are then rewashed in a 1-compartment 3-cell Type 2030 McNally-Norton jig. Clean coal from the rewash jig goes to the classifying screens and refuse to the refuse belt.

Standard sizes are ¼x0 carbon; 1¼x¼ stoker; 2x1¼ nut; 3x2 stove; and 5x3 egg and 8x5 block. Nut, stove, egg and block are produced by the main classifying screens, while 1¼x0 goes to a Robbins double-deck vibrating screen where stoker coal is made. The 1¼x¼ goes onto a 2-compartment conveyor discharging to a clean-coal loading conveyor serving Tracks 1, 2 or 3 with various combinations of 1¼- and ¼-in sizes. Stoker coal also is fed to the heating plant.

Minus ¼-in from the vibrator flows

to a sump from which it is pumped to a 6x16 Allis Chalmers vibrating screen by an 8x10 Goyne pump. The ¼x0 goes to two McNally Dryclones and from there to a 100-ton storage bin or a 25-ton consist bin. The consist bin serves to feed the desired percentage of ¼x0 to No. 1 or 2 loading booms for special orders.

A 4x14 Heyl & Patterson cyclone in the water circuit reclaims part of the underflow.

Crushing facilities are installed to take part or all the plus-2-in and reduce it to any size desired by the customer.

Product Control—A carefully worked out schedule of sampling and analysis is the basis of quality control at Boone County Coal. The basic elements are a daily sample of each car of carbon and a sample of every fourth car of 2-in nut-and-slack and stoker. Each car of surface coal also is sampled. Special sampling is done at the request of the shipping department.

Weekly screen checks are made on 2-in nut-and-slack and stoker. All other sizes are checked monthly. Float-and-sink tests are made weekly.

Maintenance

Maintenance is emphasized by Boone County Coal. A systematic approach was necessary because the organization has under its protective custody deep and strip equipment, plus preparation plant and AC and DC power systems.

Supervisors are assigned specific responsibilities and are given the authority to carry them out. The organization (see illustration) includes a chief maintenance foreman and two underground maintenance foremen (day and evening shift).

Underground mechanics are assigned to production crews. In addition to section mechanics a crew of four men and one supervisor, working from an underground shop, serve as troubleshooters and also overhaul spare equipment. These men also are called to sections to assist mechanics on major breakdowns.

The face mechanics are responsible for lubricating all face equipment. Procedure is to divide the routine maintenance work between the day- and evening-shift mechanics.

The outside shop is manned by 10 mechanics. Four of the men are as-

signed to rebuilding. Routine work does not interfere with this program. The team consists of one welder, two mechanics and one electrician. Last year 27 units were completely rebuilt, including, to name a few, loaders, shuttle cars, cutters, roof-bolters and coal drills.

Other shop men, such as, a machinist, mechanic, AC-DC electrician, armature winder, bit sharpener and welder perform jobs for the entire operation.

Most of the maintenance of the preparation plant is performed on the third shift by a six-man crew. Electricians and mechanics from the main shop troubleshoot during production shifts.

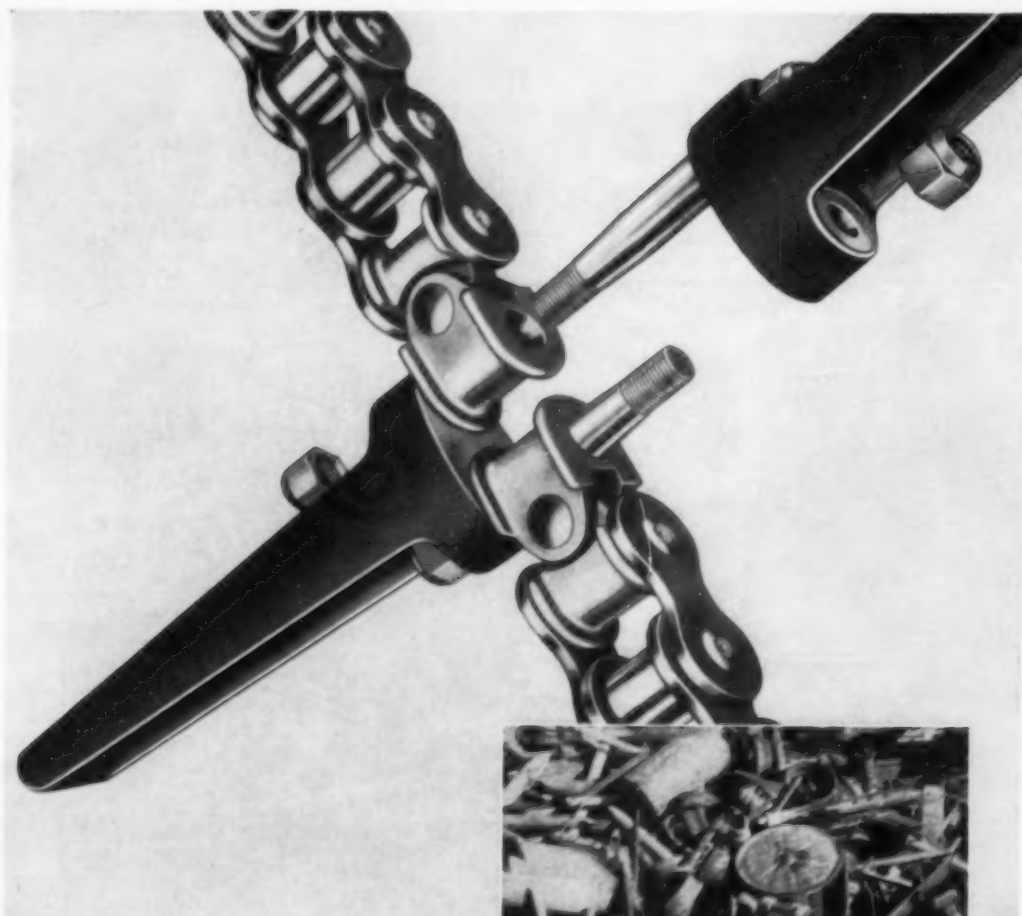
Supplies

The supply system is under the direction of Harry B. Gloss, purchasing agent, who is responsible for buying supplies and controlling inventory. At present he is setting up a supply system that will reduce the company's over-all inventory and minimize clerical duties. The system, in effect, requires two forms (see illustration): (1) a warehouse requisition for use by the various departments and (2) a perpetual inventory card. No other records are kept except a cost sheet which is sent to department heads daily. This is helpful in keeping supervisors cost-conscious. Also by analyzing the cost sheet they can detect unusual or unnecessary purchases which otherwise would not be noticed.

Safety

Both supervisors and workers are kept safety conscious at Boone County Coal. For instance, each Monday morning 15 min is set aside for a safety talk by each section foreman. Malcolm Sharpe, safety director, prepares a weekly safety letter which is distributed to each foreman. These letters are read to the crew. They contain safety tips and reports of accidents: i.e., how they happened and how to prevent them from happening again.

All supervisors are enrolled in the National Campaign Against Roof Falls and the Foremen's Club. Meetings are held monthly to view safety films and discuss various problems relating to safety and mining.



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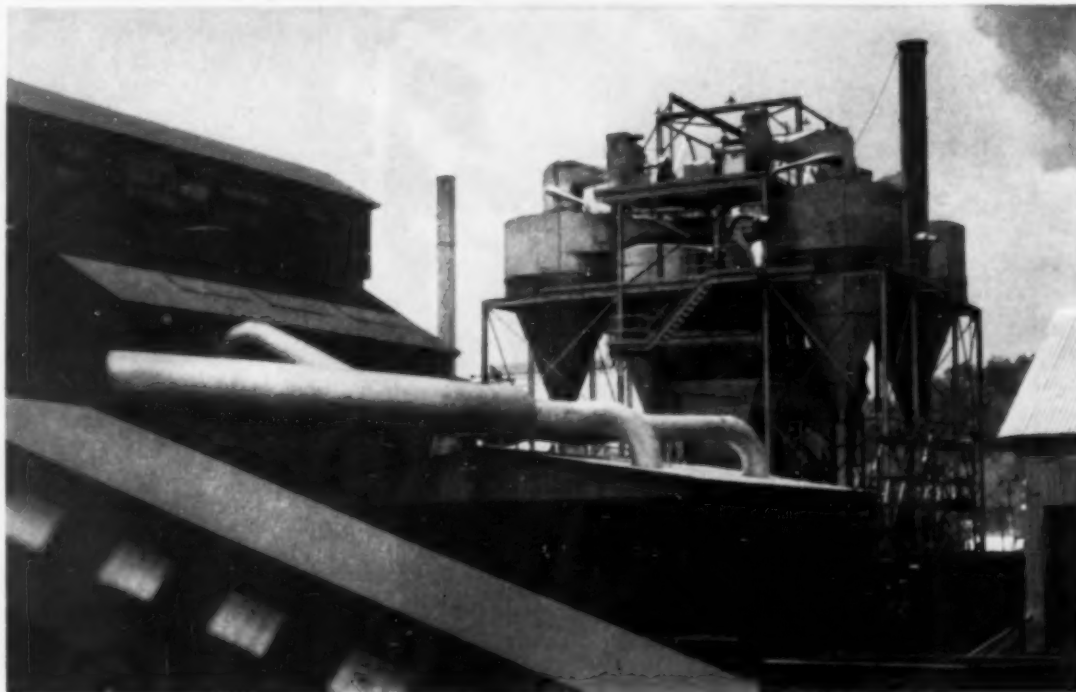
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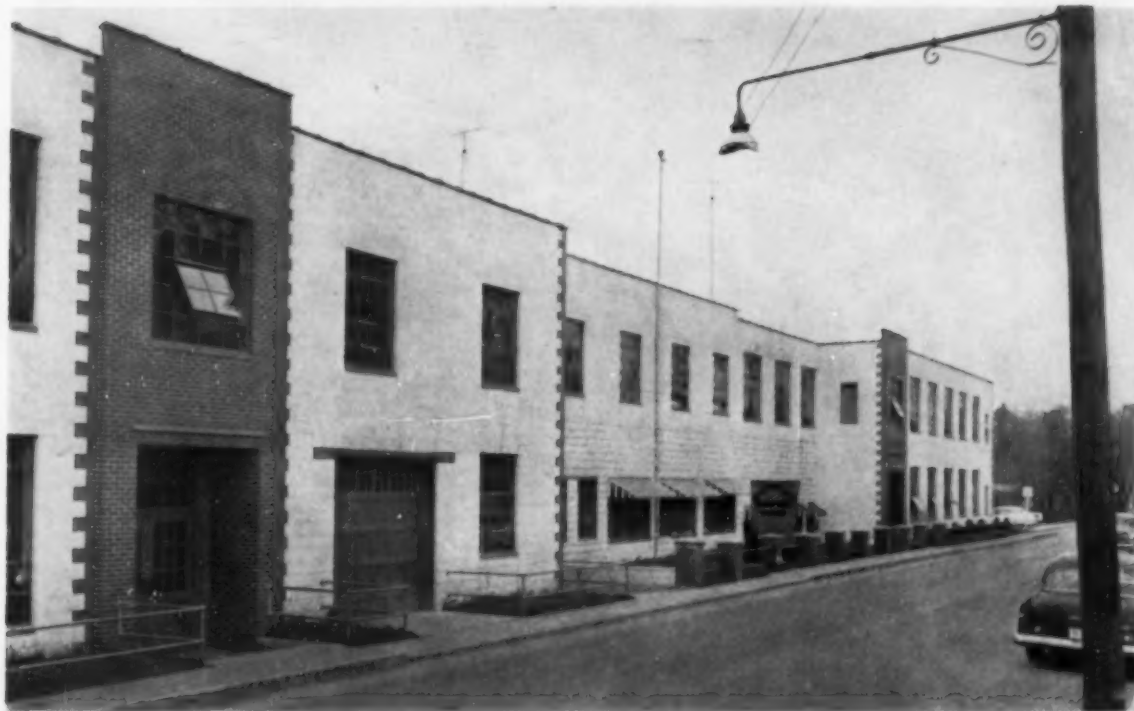
Whitney manufactures the entire product — both chain and flights — to assure complete balanced design, and a fast, complete customer service. Catalogs on request.

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PROFESSIONAL EDUCATION COUNCIL AND FACILITIES of the Raleigh County Vocational School enables coal companies to provide the best possible training for maintenance men who wish to increase their knowledge and also those starting in the maintenance game.

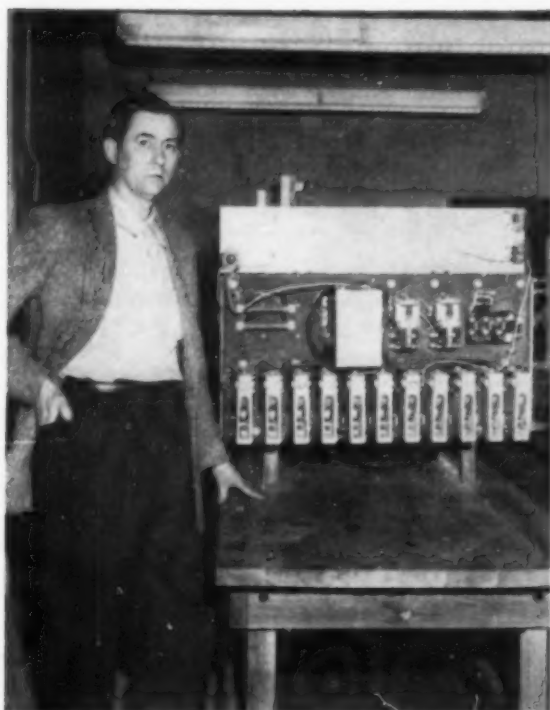
Training for More and Better Maintenance Men



PROBLEM & SOLUTION . . . "The coal industry is in an era of modernization that will require more and more technically trained men to maintain the increasing complicated and changing designs of mine machinery. Vocational schools, such as ours, are in a better position to turn out the type of maintenance men that the coal industry needs."—W. B. Connoley, director, Vocational Education, Raleigh County Schools.

How the Winding Gulf Operators' Association, jointly with the Raleigh County Vocational School, is moving to increase both the supply of maintenance men and their proficiency through fundamental and advanced courses of instruction.

WITH THE AREA'S COAL INDUSTRY already in need of qualified mine-maintenance men and faced with an even greater demand as transitions to complete mechanization continue, the Winding Gulf Operators Association and the Raleigh County Vocational School, Beckley, W. Va., have embarked on a training program to relieve the present shortage and build up a reserve of skilled electricians, mechanics and shop men for the future.



SHUTTLE CAR CONTACTOR PANELBOARD donated by a manufacturer and displayed by L. L. Fleshman Jr., electrical instructor, provides excellent laboratory exercises.



EQUIPMENT PARTS shown by Elmo Hurst, hydraulic instructor, provide students with practical experience on equipment that is actually used on mine machinery.

Organizing the Program

Although the coal industry has seldom taken advantage of state or county educational facilities to train maintenance men, the Winding Gulf Operators Association felt that with the aid of the county vocational school they could solve one of their major educational problems. With this in mind, members of the association conferred with W. B. Connoley, director of vocational education, Raleigh County Schools, in an effort to bring the coal industry and education together so that they could jointly determine what tools and facilities would be required to set up a mine-maintenance training program. This joint venture included outlining a course of study and determining the amount of time necessary to educate men in this field. The meeting resulted in an agreement by both parties to sponsor a complete training program with a definite course of study and a set amount of time allotted to each phase of the course.

The initial program started Feb. 17, 1958, and ended in late June.

It was designed to cover the fundamentals of electricity, hydraulics, mechanics and lubrication. Classes met at the vocational school for 3-hr sessions twice each week for a period of 19 wk or 114 hr. The amount of time devoted to each subject was as follows: Electricity, 9 wk; hydraulics, 5; mechanics, 4; and lubrication, 1.

Because of the limited space and facilities available for the first training program, only 48 men were permitted to attend. The number of men that each member coal company could send was based on their 1957 production, as follows:

Bolt Mining Co.	2
Brule Smokeless Coal Co.	1
Crozer Coal & Land Co. (including Buckeye Coal Co.)	4
Eastern Gas & Fuel Associates	10
Lillybrook Coal Co. (including Amigo Coal Co.)	7
C. H. Mead Coal Co.	2
Raleigh Wyoming Mining Co.	2
Slab Fork Coal Co.	6
Sterling Smokeless Coal Co.	1
Winding Gulf Coals, Inc.	13

Since the school was unable to furnish qualified instructors to teach mine-maintenance courses the association agreed to provide instructors selected from their own ranks. Those chosen were required to have at least 6 yr of practical experience in the trade. Aside from experience, selections also were based on education and willingness of individuals to devote their own time to teaching. Those selected were: Lacy L. Fleshman Jr., maintenance foreman, Slab Fork Coal Co., electrical instructor; Elmo Hurst, assistant chief engineer, Winding Gulf Coals, Inc., hydraulic instructor; M. H. Gwinn, chief mechanic, Lillybrook Coal Co., mechanical instructor; and William (Bill) Venters, shop foreman, Winding Gulf Coals, Inc., electrical instructor.

Training Facilities

Educating a maintenance man to service, repair and prevent equipment failures is a major undertaking when a coal company goes it alone. Some companies say that it takes approximately \$3,000 to train a man

Fundamentals Training

ELECTRICITY

Unit 1

What student should be able to do and use

1. Controls
2. Motors
3. Trouble-shooting
4. Instruments
5. Inspection

What student should know and understand

- Theory
Names of parts and functions
Blueprint reading
Types, parts and functions

HYDRAULICS

Unit 2

1. Controls

- a. Valves
 - (1) Manual
 - (2) Automatic

2. Motors

3. Pumps

4. Jacks

- a. Single-action
- b. Double-action

5. Oils

6. Hydraulic brakes

Theory

- Types and functions
Blueprint reading

Types and functions

Types, functions and factory settings

Types and function

Types

Types and operation

HYDRAULICS (Continued)

Unit 2

What student should be able to do and use

7. Hoses and fittings
8. Instruments
9. Inspection

What student should know and understand

- Types
Testing

MECHANICAL

Unit 3

1. Gears

2. Bearings, seals and shims

3. Shafts

4. Sprockets and chains

5. Welding

6. Inspection

Types and functions

Types and functions

Types and functions

Theory, types and metals

LUBRICATION

Unit 4

1. Greasing equipment

2. Applying lubricants properly

3. Inspection

Types of lubrication (oil and grease)

Check for proper lubrication

Advanced Training

ELECTRICITY

I—Controls

- A. Using wiring diagrams

1. Elementary — symbols

- (a) Joy equipment
- (b) Jeffrey equipment

2. Schematic

- (a) Joy equipment
- (b) Jeffrey equipment

- B. Mercury switches

- C. Timing relays

- D. Trace circuits

- E. Contactors

1. Parts

2. Operations

- F. Manually operated switches

- C. Ohmmeters

- D. Test lights and buzzers

IV—Trouble-shooting

- A. Methods

1. Test lights and buzzers

- a. Grounds
- b. Complete circuit

2. Instruments

- a. Tong-test
- b. Voltmeter
- c. Ammeter

3. Use of wiring diagrams

V—Inspection

- A. Check for worn parts

- B. Check for loose connections

HYDRAULICS

I—Controls

- A. Valves

1. Manual
2. Automatic
3. Relief

- B. Valve settings

1. Pressure
- C. Gaskets

II—Motors

- A. Tests

1. Pressure
2. Using pressure gages
3. Leakage
4. Seals

- B. Gaskets

1. Thickness
2. Materials

III—Pumps

- A. Tests

1. Pressure
2. Checking oil
3. Checking rpm

- B. Cautions in installing new pumps

1. Checking relief valves

2. Priming before starting

3. Seals

- C. Gaskets

IV—Oils

- A. Using recommended types

1. Antirust
2. Antifoam

- B. Filters

1. Recommended types
2. Self-cleaning
3. Average operating temperatures

- C. Hydraulic jacks and clutches—types and functions

1. Tests

- a. Pressure
2. Hydraulic brakes
- a. Types (disc, drum)
- b. Adjustments
- c. Brake fluids

V—Hose and fittings

- A. Types and functions

1. JIC (male and female)

- B. Fittings

1. Replacing fittings and hoses

- C. Installation

VI—Instruments

- A. Using pressure gages

VII—Inspection

- A. Visual

1. Leaks
2. Slow action or operation

MECHANICAL

I—Gears

- A. Checks

1. Mesh

2. Improper wear

- B. Installation

1. Proper alignment
- a. Use of shims

II—Bearings

- A. Types

- B. Proper installation

1. Cleanliness
2. Use of shims
3. Use of seals
4. Use of gaskets

III—Shafts

IV—Sprockets and chains

- A. Checks

1. Mesh

2. Wear

- B. Installation

1. Proper alignment
- a. Use of shims

- C. Correct pitch

1. How to measure

- D. Chains

1. Types

2. Links

- a. Types

3. How to measure

4. Checks

- a. Worn parts
- b. Twisted chains
- c. Adjustments (tension)

V—Welding

- A. Use and care of equipment

LUBRICATION

I—Greasing equipment

II—Applying lubricants properly

III—Inspection

IV—Types of oil and grease

V—Use of charts

VI—How to check for proper lubrication

on the job. Even at this cost the man is not fully trained in all phases of maintenance. This, plus other weaknesses of on-the-job training, has prompted the association to extend the training to class-room discussions.

Realizing that a good training program requires adequate facilities and a well-rounded course of studies, the association enlisted the aid of the county vocational school to help outline the complete course. Members felt that educators were better qualified to arrange for class-room studies and actual laboratory exercises, especially when they were informed on what a maintenance man should know and do. Not only is the association receiving professional education counsel but its members also are taking advantage of educational facilities which their tax dollar helps provide.

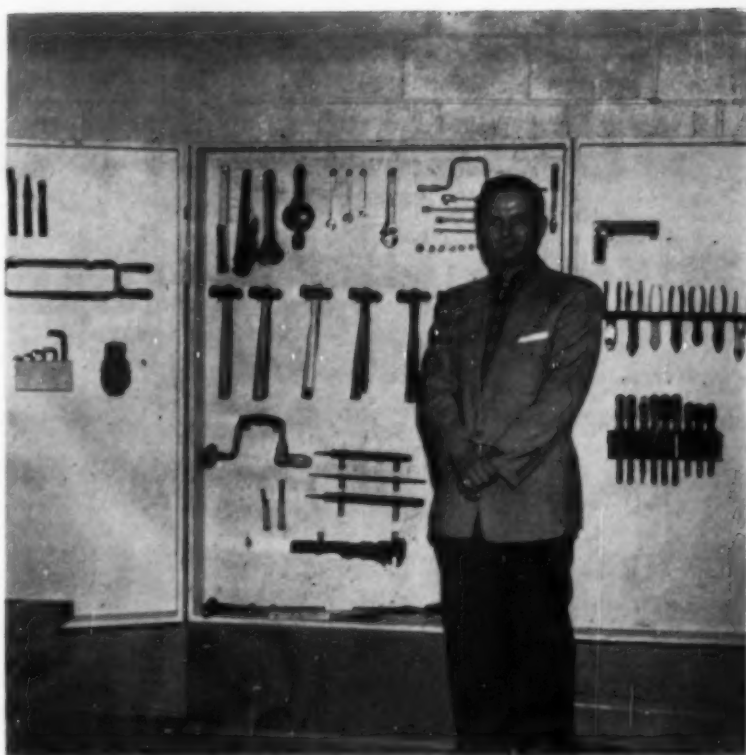
Although member companies and the school have furnished much of the material and facilities needed in setting up a training program, they are still inadequate. The goal of the organization is to obtain sufficient facilities to train as many men as wish to enroll in the course. This, however, will require considerable time and expense.

Companies that have cooperated in the program in one form or another, are as follows:

Gulf Oil Co.
Jeffrey Mfg. Co.
Joy Mfg. Co.
Mountain State Equipment Co.
Schroeder Bros.
Texas Co.
Westinghouse Electric Co.

Course of Study

At the completion of the first experimental course, Mr. Connoley emphasized that a 19-wk course is not sufficient to properly train a man for the mine-maintenance field. A breakdown of the curriculum offered to the first group of students, and of the advanced course for the fall class which began in September and will continue through May of next year, is shown in the accompanying table. Experience gained in the first class thus paved the way for a more concentrated course of studies which will require 9 mo to complete. At the same time a new group is taking the course in fundamentals. The courses are being kept flexible so



LABORATORY FACILITIES supplied by the vocational school are displayed by Bill Venters, electrical instructor.

that additional subjects can be included when they are deemed necessary and when facilities and time permit.

Twenty men are taking the fundamentals course, which was rearranged but covers the same subjects, and 21 the advanced course that began in September. Mr. Gwinn's place was taken by Herman Sparks, of the Vocational School staff, while Messrs. Fleshman, Hurst and Venters are continuing to serve as instructors in the new term. Enrollment by companies in the new term is as follows:

	Fundamentals	Advanced Training
Eastern Gas & Fuel	5	4
Lillybrook	3	4
C. H. Mead	1	1
Slab Fork	3	5
Sterling Smokeless	1	..
Winding Gulf	7	7

Instruction books used in the fundamentals class are "Electric Motor Repair," by Robert Rosenburg, Murray Hill Book Co. and "Hydraulics in Mining Equipment," by Myles E.

Altimus Jr., Pennsylvania State University, Mineral Industries Extension Service. Students are required to pay for their own.

An important part of the training program will include a series of speakers, primarily men from manufacturing companies, to talk to the students on various subjects related to mine maintenance.

Inherently, the plan is a long-range effort and it would be premature to evaluate its effects on the flow of qualified maintenance men into the area's coal industry. But by uniting all interested parties into an integrated partnership, the newly formed organization looks for steady improvement in overcoming the barrier of technical manpower shortages. The organization is highly optimistic about the success of the program. The interest shown by those who have completed the course and the long list of applicants to attend the next session have convinced both parties that they are on the right track to eliminating one of coal's toughest problems—educating maintenance men to meet the needs of tomorrow's mechanized mining.

Take it from the man in the driver's seat...here are big reasons
**why operators recommend
...to increase your daily**



▲ **"The International Pyscraper does not nose over or up in tight spots,"** states Operator Cecil Dickson, for C. & Z. Construction Co., Memphis, Tenn. The three "75's" in this fleet each get a heaped 22-yard load in 25-32 seconds—with the TD-24 as pusher. The job: building farm-to-market road near Covington, Tenn.

▶ **Operating safety is essential** on mountain terrain. Ripon Construction Co., working near Weaverville, California, appreciate International "75" Pyscraper safety — handling a sub-contract on a road in mountainous Trinity County, with three "75's" and two TD-24's for pusher power. Cuts run to 75 feet deep!

Payscrapers production!

Riding on the shock-absorbing, deep-padded seat, the International Payscraper® operator soon learns he can cross rough spots—ascend or descend steep pitches, loaded or empty—without neck-snapping, spine-smacking jolting or bouncing. He practically gets automotive riding comfort!

When he needs positive braking, he has powerful, heavy-duty four-wheel air brakes—synchronized on both tractor and scraper wheels—to decelerate and stop surely, even with heap loads on steep grades. And for “walking” the rig through soggy going, he has auxiliary hand-braking of the individual drive wheels!

Guiding a big earthmover is no longer an athletic event—no longer demands “muscle” or tussle! The Payscraper gives him exclusive Hydro-Steer—hydraulic steering powered for smooth, positive one-hand turns! Even the clutch is air-assisted for operating ease and fast, positive action!

And an operator has no fear of “nose-diving” or jack-knifing—not with International Payscraper design! The oscillating hitch assembly and forward pitched spindle prevents these machine contortions! Low center of gravity means extra stability, too, on uneven terrain.

These are big reasons why operators have the confidence to use full Payscraper power and speed—to give you full capacity and cycle-speeding loading, hauling, and return!



This new TD-20 is pusher for a pair of fast-loading ‘55’ Payscrapers—on a street improvement project in Denver. Horn Construction Co. is the contractor.

“Our three ‘55’ Payscrapers are best for our land clearing and stripping needs in this sandy area—and we compared thoroughly with competitive machines,” states Tom Hutchinson, for Hutchinson Bros., Inc., Pompano Beach, Fla. “We like the way the ‘55’s’ boil up a full load fast; then get to the fill and back quick!”



Get in the driver’s seat—get the operator’s feel of International Payscraper performance. See for yourself what a big factor complete operating ease and confidence can be in increasing earthmover capacity! See your International Construction Distributor for a demonstration!



**International®
Construction
Equipment**

International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill.

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors...Self-Propelled Scrapers and Bottom Dump Wagons...Crawlers and Rubber-Tired Loaders... Off-Highway Haulers...Diesel and Carbureted Engines...Motor Trucks...Farm Tractors and Equipment.



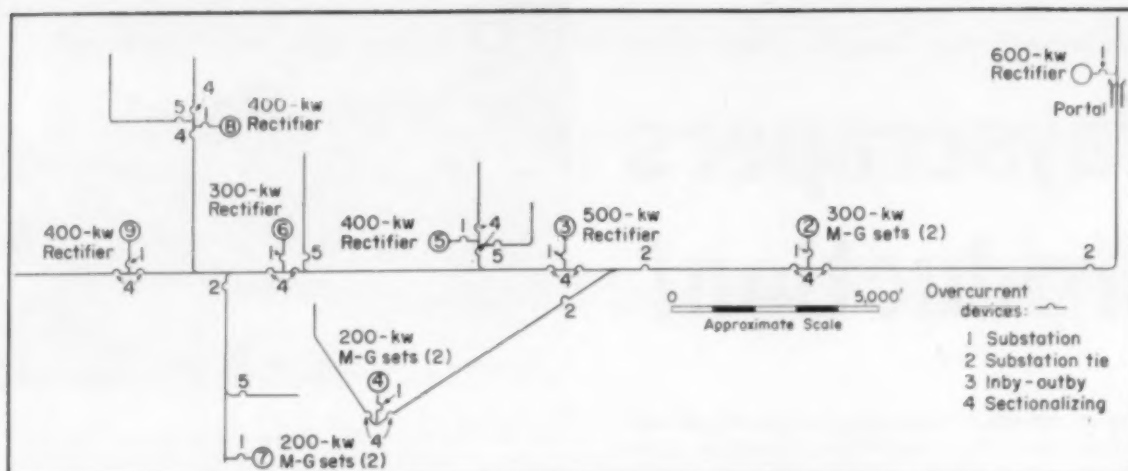


FIG. 1—Mine 1 plan, showing tie breakers between interconnected substations operating in parallel.

Overcurrent Settings for DC Circuit Breakers

Guide to DC breaker settings is based on feeder and trolley capacities and rail weights of today.

By Donald J. Baker
Mining Representative, I-T-E Circuit
Breaker Co., Inc.

SUGGESTED OVERCURRENT SETTINGS for DC feeder circuit breakers were first presented at the Charleston (W. Va.) meeting of the A.I.E.E. in 1953 (*Coal Age*, November, 1953, pp 86-89). This presentation was followed by requests for a more-complete listing of current values covering a wider range of mine circuits. As a result, the table (elsewhere in this article) has been expanded to include:

1. Distances from 1,000 to 10,000 ft in 500-ft intervals.
2. No. 9 deep-section trolley wire in combination with 500-, 1,000-, 1,500- and 2,000-MCM copper feeders.
3. Common rail sizes from 40 to 120 lb per yd.

Total resistance values for these variables are shown in the table in developing the theoretical short-cir-

cuit currents, which may be used for the ready determination of maximum overcurrent settings for circuit breakers.

To assure safe ampere selections, the maximum instantaneous current values should be derated as follows:

1. To cover errors in overcurrent relay adjusting, 2 to 5%.
2. For deficiencies resulting from imperfect bonding, high-resistance joints and worn trolley wire and track, 10 to 20%.

It is generally recognized that mine fires resulting from faulty DC power circuits can be greatly reduced through the use of sectionalizing circuit breakers. The following publications are recommended for good practice in the application of circuit breakers:

A.I.E.E. Miscellaneous Paper 48-65, "The New Sectionalization Application Standards," approved by the American Mining Congress.

U. S. Bureau of Mines Bulletin 514, "American Standard Safety Code of Installing and Using Electrical Equipment In and About Coal Mines."

Current Determination

The maximum instantaneous currents shown in the table were determined by the formulas:

Copper Resistances

$$R_1 \text{ (ohms)} = \frac{\text{Distance (ft)} \times 10.58 \text{ (copper resistivity, ohms/Mil-foot)}}{\text{(area of feeder cable + area of trolley wire) circ. mils}}$$

Track Resistances

$$R_2 \text{ (ohms)} = \frac{\text{Distance (ft)}}{\text{Pounds (per yd of rail)} \times 1,873 \text{ (track-resistivity constant)}}$$

Circuit Capacity

$$\text{Amperes} = \frac{V \text{ (substation volts)}}{R_1 \text{ (feeder cable and trolley wire)} + R_2 \text{ (track)}}$$

These formulas are considered more practical than those requiring hand-book reference tables or curves since they permit the ready determination of overcurrent settings without involved calculations.

For purposes of illustrating how the preceding tables may be applied to determine correct circuit-breaker overcurrent settings for various mining conditions, two typical DC power distribution systems for mechanized mines have been selected. Figs. 1 and 2 are one-line diagrams of these systems. Approved recommendations for applying overcurrent protective devices to mining circuits are assumed in the two examples.

Selection of safe overcurrent protective-device settings may be simplified by considering three classifications of circuits, namely: inby and outby substation circuits, tie circuits, and mechanized-section circuits.

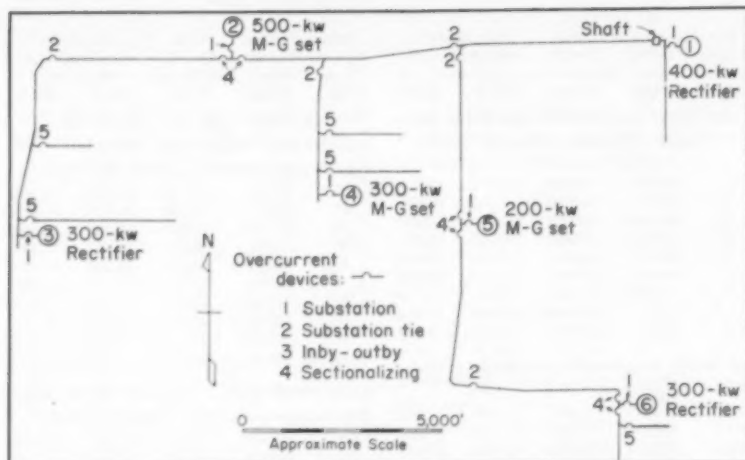


FIG. 2—Mine 2 plan, involving variations in sizes of rails and feeders.

Plan for Mine 1

The mine represented in Fig. 1 is supplied with DC power from nine substations operating in parallel and interconnected through main haulage circuits. Some of the substations serve the main haulage circuits only, whereas others serve the mechanized sections primarily and main haulage to some extent.

As indicated in Fig. 1 tie circuit breakers have been installed between all substations. No. 9 deep-section trolley wire is used exclusively. The trolley circuit is supplemented by 1,000-MCM feeder except for a few hundred feet of 500-MCM cable in some of the working sections. Main haulage track is generally 85-lb per yd, with 60-lb track elsewhere.

Use of the table can be illustrated by first noting the distance in feet between Substations 1 and 2 in Fig. 1. By scale this is about 11,000 ft. Since this is greater than the maximum distance of 10,000 ft shown in the table it will be necessary to use values for a basic circuit length of 1,000 ft. Thus, for a 1,000-ft circuit consisting of 400-MCM trolley wire paralleled by 1,000-MCM cable, with 85-lb track, the circuit breaker setting for 275 V is 19,873 amp. The setting for 11,000 ft is obtained by dividing 19,873 by 11, which gives 1,807 amp. A 12% reduction for possible error in relay adjustment, bonding losses and increased splice resistances results in a value of 1,590 amp.

Obviously the inby substation circuit breaker at Substation 1 would

be set to trip at a value only 70% of substation capacity. This would not be acceptable from an operating standpoint. A tie breaker between these two substations therefore is clearly needed.

With a tie breaker between Substations 1 and 2, the setting of the inby breaker at No. 1 or the outby at No. 2 can be increased by 100%, or not to exceed 3,180 amp, a value now practical for short-circuit protection. The tie-breaker setting should not exceed the maximum current that can flow between Substations 1 and 2 in either direction, or 1,590 amp, as already determined.

Overcurrent settings for other inby and outby substation circuit breakers, as well as the tie breakers, can be calculated quickly in like manner by use of the table.

Where more than two substations operate in parallel by reason of haulage branches, as, for example, Substations 2, 3 and 4, Fig. 1, the overcurrent settings for tie breakers should not exceed the minimum current that can flow between any two of the three substations having the highest circuit resistance. In this instance it is obvious that the highest resistance is between Substations 2 and 4.

Plan for Mine 2

In Fig. 2 the mine is supplied with 275-V DC from six substations operating in parallel and interconnected through main haulage circuits. Only two substations serve the main haul-

age exclusively: one a 400-kw rectifier in No. 1 substation at the main shaft and the second a 500-kw m-g set in the No. 2 substation to the west. The remaining substations supply both main haulage and seven mining sections. All main haulage is equipped with both No. 9-section trolley wire and 1,000-MCM feeder. Eighty- and 60-lb rail is used on the main haulageways and 40-lb in the working sections. In some of the working sections 500-MCM cable supplements the track for the return conductor. In all seven sections No. 9-section trolley wire is the only overhead conductor.

In applying the inby and outby breakers to the mine power distribution system shown in Fig. 2, the same procedure as in Mine 1 should be followed. For example, the distance between No. 1 and No. 2 substations is 8,400 ft. Referring to the table and selecting the next greater distance, or 8,500 ft, the maximum instantaneous short-circuit current at 275 V is 2,273 amp for No. 9-section trolley wire and 1,000-MCM feeder when used with 80-lb track.

Making the 12% reduction for bonding and other losses, the circuit-breaker settings should not exceed 2,000 amp each for the adjoining inby and outby breakers of these two substations. If load conditions demand a higher setting, then a tie circuit breaker should be used midway between the substations with a setting not exceeding 2,000 amp. If this is done then the adjoining inby and outby circuit breaker settings may each be increased not to exceed a safe setting for the individual substation equipment.

In determining the setting of the outby breaker at the No. 2 substation and the breaker at No. 3 substation (300-kw rectifier) to the southwest, a distance of less than 7,000 ft is involved. Approximately 3,000 ft is laid with 60-lb track and 3,800 ft with 80-lb. Where the overhead circuit is No. 9-section trolley wire paralleled by 1,000-MCM feeder, with 3,800 ft of 80-lb track connected to 3,000 ft of 60-lb, the short-circuit current is equivalent to approximately 6,800 ft of 70-lb track. This value is 2,587 amp at 275 V. Reducing by the customary 12% drops the value to 2,277 amp. In other words the setting of the

(Continued on p 102)

Maximum Instantaneous Current Values for Various DC

Rail Weight Lb per Yd	Track Resistance, Ohms	Total Circuit Resistance, Ohms	Maximum Instantaneous Amperes 275 V	Maximum Instantaneous Amperes 290 V	Rail Weight Lb per Yd	Track Resistance, Ohms	Total Circuit Resistance, Ohms	Maximum Instantaneous Amperes 275 V	Maximum Instantaneous Amperes 290 V	Rail Weight Lb per Yd	Track Resistance, Ohms	Total Circuit Resistance, Ohms	Maximum Instantaneous Amperes 275 V	Maximum Instantaneous Amperes 290 V
1,000-FT CIRCUIT LENGTH					1,000-MCM feeder with 400-MCM trolley; copper resistance, 0.004408 ohms					2,500-FT CIRCUIT LENGTH				
120	.004449	.008857	31,049	32,742	120	.006674	.018010	15,269	16,102	120	.011123	.022144	12,419	13,096
110	.004854	.009252	29,691	31,311	110	.007280	.018616	14,772	15,578	110	.012134	.023155	11,876	12,524
100	.005339	.009747	28,214	29,753	90	.008898	.020234	13,591	14,332	100	.013348	.024369	11,285	11,900
90	.005932	.010340	26,596	28,046	85	.009422	.020758	13,248	13,971	90	.014831	.025852	10,637	11,218
85	.006281	.010689	25,727	27,131	80	.010011	.021347	12,882	13,585	85	.015703	.026774	10,290	10,862
80	.006674	.011082	24,815	26,169	70	.011441	.022777	12,074	12,732	80	.016684	.027705	9,926	10,467
70	.007227	.012035	22,850	24,096	60	.013348	.024684	11,141	11,749	70	.019068	.030089	9,140	9,638
60	.008898	.013306	20,667	21,795	50	.016017	.027353	10,054	10,602	60	.022246	.033267	8,266	8,717
50	.010678	.015086	18,229	19,223	40	.020021	.031357	8,770	9,248	50	.026695	.037716	7,291	7,689
40	.012348	.017786	15,488	16,333						40	.033369	.044390	6,195	6,533
1,500-MCM feeder with 400-MCM trolley; copper resistance, 0.005568 ohms					500-MCM feeder with 400-MCM trolley; copper resistance, 0.017633 ohms					1,500-MCM feeder with 400-MCM trolley; copper resistance, 0.013921 ohms				
120	.004449	.010017	27,453	28,951	120	.006674	.024307	11,314	11,931	120	.011123	.025044	10,981	11,580
110	.004854	.010422	26,396	27,826	110	.007280	.024913	11,038	11,641	110	.012134	.026055	10,555	11,130
100	.005339	.010907	25,213	26,588	100	.008898	.025642	10,725	11,310	100	.013348	.027269	10,085	10,635
90	.005932	.011500	23,813	25,217	90	.009422	.026331	10,365	10,931	90	.014831	.028752	9,565	10,086
85	.006281	.011849	23,209	24,475	85	.010011	.027055	10,164	10,719	85	.015703	.029624	9,283	9,789
80	.006674	.012242	22,464	23,689	80	.011441	.027644	9,948	10,491	80	.016684	.030605	8,985	9,476
70	.007227	.013195	20,841	21,978	70	.013348	.029074	9,459	9,975	70	.019068	.032989	8,336	8,791
60	.008898	.014466	19,010	20,047	60	.016017	.030981	8,876	9,361	60	.022246	.036167	7,604	8,018
50	.010678	.016246	16,927	17,851	50	.020021	.032650	8,172	8,618	50	.026695	.040616	6,771	7,140
40	.012348	.018916	14,538	15,331	40	.020021	.037654	7,303	7,702	40	.033369	.047290	5,815	6,132
2,000-MCM feeder with 400-MCM trolley; copper resistance, 0.008817 ohms					2,000-FT CIRCUIT LENGTH					1,000-MCM feeder with 400-MCM trolley; copper resistance, 0.013893 ohms				
120	.004449	.012095	22,905	24,155	120	.008898	.017715	15,524	16,370	120	.011123	.030016	9,162	9,662
110	.004854	.012411	22,158	23,366	110	.009707	.018524	14,846	15,655	110	.012134	.031027	8,863	9,347
100	.005339	.012996	21,324	22,488	100	.010678	.019495	14,106	14,876	100	.013348	.032241	8,530	8,995
90	.005932	.013489	20,387	21,499	90	.011665	.020682	13,297	14,022	90	.014831	.033724	8,154	8,599
85	.006281	.013838	19,873	20,957	85	.012562	.021379	12,863	13,565	85	.015703	.034596	7,949	8,382
80	.006674	.014231	19,324	20,378	80	.013348	.022165	12,407	13,084	80	.016684	.035577	7,730	8,151
70	.007227	.015184	18,111	19,099	70	.015254	.024071	11,425	12,048	70	.019068	.037961	7,244	7,639
60	.008898	.016465	16,712	17,624	60	.017797	.026614	10,333	10,897	60	.022246	.041139	6,686	7,049
50	.010678	.018235	15,081	15,903	50	.021356	.030173	9,114	9,611	50	.026695	.045588	6,032	6,361
40	.012348	.020905	13,155	13,872	40	.026695	.035512	7,744	8,166	40	.033369	.052262	5,262	5,549
500-MCM feeder with 400-MCM trolley; copper resistance, 0.011756 ohms					1,500-MCM feeder with 400-MCM trolley; copper resistance, 0.011137 ohms					500-MCM feeder with 400-MCM trolley; copper resistance, 0.029389 ohms				
120	.004449	.016205	16,970	17,896	120	.008898	.020035	13,726	14,475	120	.011123	.040512	6,788	7,158
110	.004854	.016610	16,556	17,459	110	.009707	.020844	13,193	13,913	110	.012134	.041523	6,623	6,984
100	.005339	.017095	16,087	16,964	100	.010678	.021815	12,606	13,294	100	.013348	.042737	6,435	6,786
90	.005932	.017688	15,547	16,395	90	.011665	.023002	11,945	12,597	90	.014831	.044220	6,219	6,558
85	.006281	.018037	15,246	16,078	85	.012562	.023699	11,604	12,237	85	.015703	.045092	6,099	6,431
80	.006674	.018430	14,921	15,735	80	.013348	.024485	11,231	11,844	80	.016684	.046073	5,969	6,294
70	.007227	.019383	14,188	14,962	70	.015254	.026391	10,420	10,989	70	.019068	.048457	5,575	5,905
60	.008898	.020654	13,315	14,041	60	.017797	.028934	9,504	10,023	60	.022246	.051635	5,326	5,616
50	.010678	.022434	12,258	12,927	50	.021356	.032493	8,463	8,925	50	.026695	.056084	4,903	5,171
40	.012348	.025104	10,954	11,552	40	.026695	.037832	7,269	7,665	40	.033369	.062758	4,382	4,621
1,500-FT CIRCUIT LENGTH					3,000-FT CIRCUIT LENGTH					2,000-MCM feeder with 400-MCM trolley; copper resistance, 0.013225 ohms				
120	.006674	.013286	20,698	21,827	120	.008898	.024012	11,453	12,077	120	.013348	.026573	10,349	10,913
110	.007280	.013892	19,796	20,875	110	.009707	.024821	11,079	11,684	110	.014561	.027786	9,897	10,437
100	.008009	.014621	18,809	19,834	100	.010678	.025792	10,662	11,244	100	.016017	.029242	9,404	9,917
90	.008898	.015510	17,730	18,696	90	.011665	.026979	10,193	10,749	90	.017797	.031022	8,865	9,348
85	.009422	.016034	17,151	18,087	85	.012562	.027676	9,936	10,478	85	.018844	.032069	8,575	9,043
80	.010011	.016623	16,543	17,446	80	.013348	.028462	9,662	10,189	80	.020021	.033246	8,272	8,723
70	.011441	.018053	15,233	16,064	70	.015254	.030368	9,056	9,550	70	.022882	.036107	7,616	8,032
60	.013348	.019950	13,778	14,529	60	.017797	.032911	8,356	8,812	60	.026695	.039920	6,889	7,265
50	.016017	.022629	12,153	12,815	50	.021356	.036470	7,540	7,952	50	.032034	.045259	6,076	6,408
40	.020021	.026633	10,326	10,889	40	.026695	.041809	6,578	6,936	40	.040043	.053268	5,153	5,444
1,500-MCM feeder with 400-MCM trolley; copper resistance, 0.008353 ohms					500-MCM feeder with 400-MCM trolley; copper resistance, 0.023511 ohms					1,500-MCM feeder with 400-MCM trolley; copper resistance, 0.016705 ohms				
120	.006674	.015037	18,300	19,299	120	.008898	.032409	8,455	8,948	120	.013348	.030053	9,151	9,650
110	.007280	.015633	17,591	18,551	110	.009707	.033218	8,278	8,730	110	.014561	.031266	8,795	9,275
100	.008009	.016362	16,807	17,724	100	.010678	.034189	8,044	8,482	100	.016017	.032722	8,404	8,863
90	.008898	.017251	15,941	16,811	90	.011665	.035376	7,774	8,198	90	.017797	.034502	7,971	8,405
85	.009422	.017775	15,471	16,315	85	.012562	.036073	7,623	8,039	85	.018844	.035549	7,736	8,158
80	.010011	.018364	14,975	15,792	80	.013348	.036859	7,461	7,868	80	.020021	.036726	7,488	7,896
70	.011441	.019794	13,893	14,651	70	.015254	.038765	7,094	7,481	70	.022882	.039587	6,947	7,326
60	.013348	.021701	12,672	13,363	60	.017797	.041308	6,657	7,020	60	.026695	.043400	6,336	6,682
50	.016017	.024370	11,284	11,900	50	.021356	.044867	6,129	6,464	50	.032034	.048739	5,642	5,950
40	.020021	.028374	9,692	10,221	40	.026695	.050206	5,477	5,776	40	.040043	.056748	4,846	5,110

Circuit Lengths, Conductor Sizes and Rail Weights

Rail Weight
Lb per
Yd

Track Resistance,
Ohms

Total Circuit Resistance,
Ohms

Maximum Instantaneous Amperes
275 V 290 V

1,000-MCM feeder with 400-MCM trolley; copper resistance, 0.022671 ohms

120	.013348	.036019	7.635	8.051
110	.014561	.037232	7.386	7.789
100	.016017	.038688	7.168	7.496
90	.017797	.040468	6.795	7.165
85	.018844	.041515	6.624	6.985
80	.020021	.042692	6.441	6.793
70	.022882	.045653	6.037	6.366
60	.026695	.049366	5.571	5.874
50	.032034	.054705	5.027	5.301
40	.040043	.062714	4.385	4.624

500-MCM feeder with 400-MCM trolley; copper resistance, 0.035267 ohms

120	.013348	.048515	5.657	5.965
110	.014561	.049828	5.519	5.820
100	.016017	.051284	5.362	5.655
90	.017797	.053064	5.182	5.465
85	.018844	.054111	5.082	5.359
80	.020021	.055288	4.974	5.245
70	.022882	.058149	4.729	4.987
60	.026695	.061962	4.438	4.680
50	.032034	.067301	4.086	4.309
40	.040043	.075310	3.652	3.851

3,500-FT CIRCUIT LENGTH

2,000-MCM feeder with 400-MCM trolley; copper resistance, 0.015429 ohms

120	.015572	.031001	8.871	9.355
110	.016988	.032417	8.483	8.946
100	.018687	.034116	8.061	8.500
90	.020763	.036192	7.598	8.013
85	.021984	.037413	7.350	7.751
80	.023358	.038787	7.090	7.477
70	.026695	.042124	6.528	6.884
60	.031144	.046573	5.905	6.227
50	.037373	.052802	5.208	5.492
40	.046716	.062145	4.425	4.667

1,500-MCM feeder with 400-MCM trolley; copper resistance, 0.019489 ohms

120	.015572	.035061	7.843	8.271
110	.016988	.036477	7.539	7.950
100	.018687	.038176	7.203	7.596
90	.020763	.040252	6.832	7.205
85	.021984	.041473	6.631	6.993
80	.023358	.042847	6.418	6.768
70	.026695	.046184	5.954	6.279
60	.031144	.050633	5.431	5.727
50	.037373	.056862	4.836	5.100
40	.046716	.066205	4.154	4.380

1,000-MCM feeder with 400-MCM trolley; copper resistance, 0.026450 ohms

120	.015572	.042022	6.544	6.901
110	.016988	.043438	6.331	6.676
100	.018687	.045137	6.093	6.425
90	.020763	.047213	5.825	6.142
85	.021984	.048434	5.678	5.988
80	.023358	.049808	5.521	5.822
70	.026695	.053145	5.175	5.457
60	.031144	.057594	4.775	5.035
50	.037373	.063823	4.309	4.544
40	.046716	.073166	3.759	3.964

500-MCM feeder with 400-MCM trolley; copper resistance, 0.041144 ohms

120	.015572	.056716	4.849	5.113
110	.016988	.058132	4.731	4.989
100	.018687	.059831	4.596	4.847
90	.020763	.061907	4.442	4.684
85	.021984	.063128	4.356	4.594
80	.023358	.064502	4.263	4.496
70	.026695	.067839	4.054	4.275
60	.031144	.072288	3.804	4.012
50	.037373	.078517	3.502	3.693
40	.046716	.087860	3.130	3.301

Rail Weight
Lb per
Yd

Track Resistance,
Ohms

Total Circuit Resistance,
Ohms

Maximum Instantaneous Amperes
275 V 290 V

4,000-FT CIRCUIT LENGTH

2,000-MCM feeder with 400-MCM trolley; copper resistance, 0.017633 ohms

120	.017797	.035430	7.762	8.185
110	.019415	.037048	7.423	7.828
100	.021356	.038989	7.063	7.438
90	.023729	.041362	6.649	7.011
85	.025125	.042768	6.432	6.782
80	.026695	.044328	6.204	6.542
70	.030509	.048142	5.712	6.024
60	.036594	.053227	5.167	5.448
50	.042712	.060345	4.567	4.806
40	.053390	.071023	3.872	4.083

1,500-MCM feeder with 400-MCM trolley; copper resistance, 0.022274 ohms

120	.017797	.040071	6.863	7.237
110	.019415	.041689	6.596	6.956
100	.021356	.043630	6.303	6.647
90	.023729	.046003	5.978	6.304
85	.025125	.047399	5.802	6.118
80	.026695	.048969	5.616	5.922
70	.030509	.052783	5.210	5.494
60	.036594	.057868	4.752	5.011
50	.042712	.064966	4.232	4.462
40	.053390	.075644	3.634	3.833

1,000-MCM feeder with 400-MCM trolley; copper resistance, 0.030229 ohms

120	.017797	.048026	5.726	6.038
110	.019415	.049644	5.539	5.842
100	.021356	.051585	5.331	5.622
90	.023729	.053958	5.097	5.375
85	.025125	.055354	4.968	5.239
80	.026695	.056924	4.831	5.095
70	.030509	.060738	4.528	4.775
60	.036594	.065823	4.178	4.406
50	.042712	.072941	3.770	3.976
40	.053390	.083619	3.289	3.468

500-MCM feeder with 400-MCM trolley; copper resistance, 0.047822 ohms

120	.017797	.064819	4.243	4.474
110	.019415	.066437	4.139	4.365
100	.021356	.068378	4.022	4.241
90	.023729	.070781	3.887	4.099
85	.025125	.072147	3.812	4.020
80	.026695	.073717	3.730	3.934
70	.030509	.077531	3.547	3.740
60	.036594	.082616	3.329	3.510
50	.042712	.089734	3.065	3.232
40	.053390	.100412	2.739	2.888

4,500-FT CIRCUIT LENGTH

2,000-MCM feeder with 400-MCM trolley; copper resistance, 0.019837 ohms

120	.020021	.039858	6.899	7.276
110	.021841	.041678	6.598	6.958
100	.024026	.043863	6.270	6.611
90	.026695	.046532	5.910	6.232
85	.028265	.048102	5.717	6.029
80	.030032	.049869	5.514	5.815
70	.034322	.054159	5.078	5.355
60	.040043	.059880	4.593	4.843
50	.048051	.067888	4.051	4.272
40	.060064	.079901	3.442	3.629

1,500-MCM feeder with 400-MCM trolley; copper resistance, 0.025058 ohms

120	.020021	.045079	6.100	6.433
110	.021841	.046899	5.864	6.184
100	.024026	.049084	5.603	5.908
90	.026695	.051753	5.314	5.604
85	.028265	.053323	5.157	5.439
80	.030032	.055090	4.992	5.264
70	.034322	.059380	4.631	4.894
60	.040043	.065101	4.224	4.465
50	.048051	.073109	3.762	3.967
40	.060064	.085122	3.231	3.407

Rail Weight
Lb per
Yd

Track Resistance,
Ohms

Total Circuit Resistance,
Ohms

Maximum Instantaneous Amperes
275 V 290 V

1,000-MCM feeder with 400-MCM trolley; copper resistance, 0.034007 ohms

120	.020021	.054028	5.090	5.368
110	.021841	.055848	4.924	5.193
100	.024026	.058033	4.739	4.997
90	.026695	.060702	4.530	4.777
85	.028265	.062272	4.416	4.657
80	.030032	.064039	4.294	4.528
70	.034322	.068329	4.025	4.244
60	.040043	.074505	3.714	3.916
50	.048051	.082058	3.351	3.534
40	.060064	.093071	2.955	3.116

500-MCM feeder with 400-MCM trolley; copper resistance, 0.052900 ohms

120	.020021	.072921	3.771	3.977
110	.021841	.074741	3.679	3.880
100	.024026	.076926	3.575	3.770
90	.026695	.079596	3.455	3.643
85	.028265	.081165	3.388	3.573
80	.030032	.082932	3.316	3.497
70	.034322	.087222	3.153	3.325
60	.040043	.092943	2.959	3.120
50	.048051	.100861	2.724	2.873
40	.060064	.112964	2.434	2.567

5,000-FT CIRCUIT LENGTH

2,000-MCM feeder with 400-MCM trolley; copper resistance, 0.022042 ohms

120	.022246	.044288	6.209	6.548
110	.024268	.046310	5.938	6.262
100	.026695	.048737	5.643	5.950
90	.029661	.051703	5.319	5.609
85	.031406	.053448	5.145	5.426
80	.033369	.055411	4.963	5.234
70	.038136	.060178	4.570	4.819
60	.044492	.066534	4.133	4.359
50	.053390	.075432	3.646	3.845
40	.066738	.088780	3.098	3.267

1,500-MCM feeder with 400-MCM trolley; copper resistance, 0.027842 ohms

120	.022246	.050088	5.490	5.790
110	.024268	.052110	5.277	5.565
100	.026695	.054537	5.042	5.317
90	.029661	.057503	4.782	5.043
85	.031406	.059248	4.642	4.895
80	.033369	.061211	4.493	4.738
70	.038136	.066878	4.168	4.395
60	.044492	.072334	3.802	4.009
50	.053390	.081232	3.385	3.570
40	.066738	.094580	2.908	3.066

1,000-MCM feeder with 400-MCM trolley; copper resistance, 0.037786 ohms

120	.022246	.060032	4.581	4.831
110	.024268	.062054	4.432	4.673
100	.026695	.064481	4.265	4.497
90	.029661	.067447	4.077	4.300
85	.031406	.069192	3.974	4.191
80	.033369	.071155	3.865	4.076
70	.038136	.075922	3.622	3.820
60	.044492	.082278	3.342	3.525
50	.053390	.091176	3.016	3.181
40	.066738	.104524	2.631	2.774

500-MCM feeder with 400-MCM trolley; copper resistance, 0.058778 ohms

120	.022246	.081024	3.394	3.579
110	.024268	.083046	3.311	3.492
100	.026695	.085473	3.217	3.393
90	.029661	.088439	3.109	3.279
85	.031406	.090184	3.049	3.216
80	.033369	.092147	2.984	3.147
70	.038136	.096914	2.838	2.992
60	.044492	.103270	2.663	2.808
50	.053390	.112168	2.452	2.585
40	.066738	.125516	2.191	2.310

(Continued)

Maximum Instantaneous Current Values of Various DC

5,500-FT CIRCUIT LENGTH					1,000-MCM feeder with 400-MCM trolley; copper resistance, 0.045343 ohms					7,000-FT CIRCUIT LENGTH				
Rail Weight Lb per Yd	Track Resistance, Ohms	Total Circuit Resistance, Ohms	Maximum Instantaneous Amperes 275 V 290 V		Rail Weight Lb per Yd	Track Resistance, Ohms	Total Circuit Resistance, Ohms	Maximum Instantaneous Amperes 275 V 290 V		Rail Weight Lb per Yd	Track Resistance, Ohms	Total Circuit Resistance, Ohms	Maximum Instantaneous Amperes 275 V 290 V	
2,000-MCM feeder with 400-MCM trolley; copper resistance, 0.024246 ohms					2,000-MCM feeder with 400-MCM trolley; copper resistance, 0.030858 ohms					1,500-MCM feeder with 400-MCM trolley; copper resistance, 0.039579 ohms				
120	.024471	.048717	5,645 5,963		120	.026695	.072038	3,817 4,026		120	.031144	.062002	4,435 4,677	
110	.026695	.050841	5,398 5,693		110	.029122	.074465	3,693 3,894		110	.033976	.064834	4,242 4,473	
100	.029365	.053611	5,130 5,409		100	.032034	.077377	3,554 3,748		100	.037373	.068231	4,030 4,250	
90	.032627	.056873	4,835 5,099		90	.035594	.080337	3,398 3,583		90	.041526	.072384	3,799 4,006	
85	.034547	.058793	4,677 4,933		85	.037687	.083030	3,312 3,493		85	.043968	.074826	3,675 3,876	
80	.036706	.060952	4,512 4,758		80	.040043	.084396	3,259 3,437		80	.046716	.077574	3,545 3,738	
70	.041905	.066196	4,154 4,381		70	.045763	.091106	3,018 3,183		70	.053390	.084248	3,264 3,442	
60	.048941	.073187	3,757 3,962		60	.053390	.098733	2,785 2,937		60	.062289	.093147	2,952 3,113	
50	.056729	.082975	3,314 3,495		50	.064068	.109411	2,513 2,651		50	.074746	.105604	2,604 2,748	
40	.073412	.097658	2,816 2,970		40	.080085	.125428	2,192 2,312		40	.093433	.124291	2,213 2,333	
1,500-MCM feeder with 400-MCM trolley; copper resistance, 0.030626 ohms					500-MCM feeder with 400-MCM trolley; copper resistance, 0.070533 ohms					1,500-MCM feeder with 400-MCM trolley; copper resistance, 0.039579 ohms				
120	.024471	.055097	4,991 5,263		120	.026695	.097228	2,828 2,983		120	.031144	.070123	3,922 4,136	
110	.026695	.057321	4,798 5,059		110	.029122	.099555	2,760 2,910		110	.033976	.072956	3,769 3,975	
100	.029365	.059891	4,584 4,834		100	.032034	.102567	2,681 2,827		100	.037373	.076352	3,602 3,798	
90	.032627	.063253	4,348 4,585		90	.035594	.106127	2,591 2,733		90	.041526	.080505	3,416 3,602	
85	.034547	.065713	4,220 4,450		85	.037687	.108220	2,541 2,680		85	.043968	.082947	3,315 3,496	
80	.036706	.067332	4,084 4,307		80	.040043	.110576	2,487 2,623		80	.046716	.085895	3,209 3,384	
70	.041905	.072531	3,791 3,998		70	.045763	.116296	2,385 2,494		70	.053390	.092369	2,977 3,140	
60	.048941	.079567	3,456 3,645		60	.053390	.123923	2,219 2,340		60	.062289	.101268	2,716 2,864	
50	.056729	.089355	3,078 3,245		50	.064068	.134601	2,043 2,155		50	.074746	.113725	2,418 2,550	
40	.073412	.104038	2,643 2,787		40	.080085	.150618	1,826 1,925		40	.093433	.132412	2,077 2,190	
1,000-MCM feeder with 400-MCM trolley; copper resistance, 0.041564 ohms					6,500-FT CIRCUIT LENGTH					1,000-MCM feeder with 400-MCM trolley; copper resistance, 0.052900 ohms				
120	.024471	.066035	4,164 4,392		120	.028920	.057574	4,776 5,037		120	.031144	.085044	3,234 3,419	
110	.026695	.068259	4,029 4,249		110	.031549	.060203	4,568 4,817		110	.033976	.088676	3,165 3,338	
100	.029365	.070829	3,877 4,088		100	.034704	.063358	4,340 4,577		100	.037373	.090273	3,046 3,212	
90	.032627	.074191	3,707 3,909		90	.038560	.067214	4,091 4,315		90	.041526	.094426	2,912 3,071	
85	.034547	.076111	3,613 3,810		85	.040828	.069482	3,958 4,174		85	.043968	.096868	2,839 2,994	
80	.036706	.078270	3,513 3,705		80	.043380	.072034	3,818 4,026		80	.046716	.099616	2,761 2,911	
70	.041905	.083469	3,296 3,474		70	.049577	.078231	3,515 3,707		70	.053390	.106290	2,587 2,728	
60	.048941	.090505	3,039 3,204		60	.057839	.086493	3,179 3,353		60	.062289	.115189	2,387 2,518	
50	.056729	.100293	2,742 2,892		50	.069407	.098061	2,804 2,957		50	.074746	.127646	2,154 2,272	
40	.073412	.114976	2,392 2,522		40	.086759	.115413	2,383 2,513		40	.093433	.146333	1,879 1,982	
500-MCM feeder with 400-MCM trolley; copper resistance, 0.064656 ohms					1,500-MCM feeder with 400-MCM trolley; copper resistance, 0.036195 ohms					500-MCM feeder with 400-MCM trolley; copper resistance, 0.082289 ohms				
120	.024471	.089127	3,085 3,254		120	.028920	.065115	4,223 4,454		120	.031144	.113433	2,424 2,557	
110	.026695	.091351	3,010 3,175		110	.031549	.067744	4,059 4,281		110	.033976	.116255	2,365 2,494	
100	.029365	.094021	2,925 3,084		100	.034704	.070899	3,879 4,090		100	.037373	.119662	2,298 2,423	
90	.032627	.097283	2,827 2,981		90	.038560	.074755	3,679 3,879		90	.041526	.123815	2,221 2,342	
85	.034547	.099203	2,772 2,923		85	.040828	.077023	3,670 3,765		85	.043968	.126257	2,178 2,297	
80	.036706	.101362	2,713 2,861		80	.043380	.079575	3,456 3,644		80	.046716	.129005	2,132 2,248	
70	.041905	.106561	2,581 2,721		70	.049577	.085772	3,206 3,381		70	.053390	.135679	2,027 2,137	
60	.048941	.113597	2,421 2,553		60	.057839	.094034	2,924 3,084		60	.062289	.144578	1,902 2,006	
50	.056729	.123385	2,229 2,350		50	.069407	.105602	2,604 2,746		50	.074746	.157035	1,751 1,847	
40	.073412	.139058	1,992 2,100		40	.086759	.122954	2,237 2,359		40	.093433	.175722	1,586 1,680	
6,000-FT CIRCUIT LENGTH					1,000-MCM feeder with 400-MCM trolley; copper resistance, 0.049121 ohms					7,500-FT CIRCUIT LENGTH				
120	.026695	.053145	5,175 5,457		120	.028920	.078041	3,524 3,716		120	.033369	.066431	4,140 4,365	
110	.029122	.055572	4,949 5,218		110	.031549	.080670	3,409 3,595		110	.036402	.069464	3,959 4,175	
100	.032034	.058484	4,702 4,959		100	.034704	.083825	3,281 3,460		100	.040043	.073105	3,762 3,967	
90	.035594	.062044	4,432 4,674		90	.038560	.087681	3,136 3,307		90	.044492	.077554	3,546 3,739	
85	.037687	.064137	4,288 4,522		85	.040828	.089949	3,057 3,224		85	.047109	.080171	3,430 3,617	
80	.040043	.066493	4,136 4,361		80	.043380	.092501	2,973 3,135		80	.050053	.083115	3,309 3,489	
70	.045763	.072213	3,808 4,016		70	.049577	.098698	2,786 2,938		70	.057204	.090256	3,047 3,213	
60	.053390	.079840	3,444 3,632		60	.057839	.106960	2,571 2,711		60	.066739	.099801	2,755 2,906	
50	.064068	.090518	3,038 3,204		50	.069407	.118528	2,320 2,447		50	.080085	.113147	2,430 2,563	
40	.080085	.106535	2,581 2,722		40	.086759	.135880	2,024 2,134		40	.100107	.133169	2,065 2,178	
1,500-MCM feeder with 400-MCM trolley; copper resistance, 0.033411 ohms					500-MCM feeder with 400-MCM trolley; copper resistance, 0.076411 ohms					1,500-MCM feeder with 400-MCM trolley; copper resistance, 0.041763 ohms				
120	.026695	.060106	4,575 4,825		120	.028920	.105331	2,611 2,753		120	.033369	.075132	3,660 3,860	
110	.029122	.062533	4,398 4,638		110	.031549	.107960	2,547 2,686		110	.036402	.078165	3,518 3,710	
100	.032034	.065445	4,202 4,431		100	.034704	.111115	2,475 2,610		100	.040043	.081806	3,362 3,545	
90	.035594	.069005	3,985 4,203		90	.038560	.114971	2,392 2,522		90	.044492	.086255	3,188 3,362	
85	.037687	.071098	3,868 4,079		85	.040828	.117239	2,346 2,474		85	.047109	.088872	3,094 3,263	
80	.040043	.073454	3,744 3,948		80	.043380	.119791	2,296 2,421		80	.050053	.091816	2,995 3,158	
70	.045763	.079174	3,473 3,663		70	.049577	.125988	2,163 2,302		70	.057204	.098967	2,779 2,930	
60	.053390	.086801	3,168 3,341		60	.057839	.134250	2,048 2,160		60	.066739	.108602	2,535 2,673	
50	.064068	.097479	2,821 2,975		50	.069407	.145818	1,886 1,989		50	.080085	.121848	2,257 2,380	
40	.080085	.113496	2,423 2,565		40	.086759	.163170	1,685 1,777		40	.100107	.141870	1,938 2,044	

Circuit Lengths, Conductor Sizes and Rail Weights

Rail Track Total Maximum
Weight Resistance Circuit Instantaneous
Lb per Ohms Resistance, Amperes
Yd Ohms Ohms 275 V 290 V

1,000-MCM feeder with 400-MCM trolley; copper resistance, 0.056679 ohms

120	.033369	.090048	3,054	3,221
110	.036402	.093081	2,954	3,116
100	.040043	.096722	2,843	2,998
90	.044492	.101171	2,718	2,866
85	.047109	.103788	2,650	2,794
80	.050063	.106732	2,577	2,717
70	.057204	.113883	2,415	2,546
60	.066739	.123418	2,228	2,350
50	.080085	.136764	2,011	2,120
40	.100107	.156786	1,754	1,850

500-MCM feeder with 400-MCM trolley; copper resistance, 0.088167 ohms

120	.033369	.121636	2,263	2,386
110	.036402	.124669	2,208	2,328
100	.040043	.128210	2,145	2,262
90	.044492	.132659	2,073	2,186
85	.047109	.135276	2,033	2,144
80	.050063	.138220	1,990	2,098
70	.057204	.145371	1,892	1,995
60	.066739	.154906	1,775	1,872
50	.080085	.168252	1,634	1,724
40	.100107	.188274	1,461	1,540

8,000-FT CIRCUIT LENGTH

2,000-MCM feeder with 400-MCM trolley; copper resistance, 0.035267 ohms

120	.035594	.070861	3,881	4,093
110	.038829	.074096	3,711	3,914
100	.042712	.077979	3,527	3,719
90	.047458	.082725	3,324	3,506
85	.050250	.085517	3,216	3,391
80	.053390	.088657	3,102	3,271
70	.061017	.096284	2,866	3,012
60	.071187	.106454	2,583	2,724
50	.085424	.120691	2,279	2,403
40	.106781	.142048	1,936	2,042

1,500-MCM feeder with 400-MCM trolley; copper resistance, 0.044547 ohms

120	.035594	.080141	3,431	3,619
110	.038829	.083376	3,298	3,478
100	.042712	.087259	3,152	3,323
90	.047458	.092005	2,989	3,162
85	.050250	.094797	2,901	3,059
80	.053390	.097937	2,808	2,961
70	.061017	.105564	2,605	2,747
60	.071187	.115734	2,376	2,506
50	.085424	.129971	2,116	2,231
40	.106781	.151328	1,817	1,916

1,000-MCM feeder with 400-MCM trolley; copper resistance, 0.060457 ohms

120	.035594	.096051	2,863	3,019
110	.038829	.099286	2,770	2,921
100	.042712	.103169	2,666	2,811
90	.047458	.107915	2,548	2,687
85	.050250	.110767	2,484	2,620
80	.053390	.113847	2,416	2,547
70	.061017	.121564	2,262	2,386
60	.071187	.131644	2,089	2,203
50	.085424	.145881	1,885	1,988
40	.106781	.167238	1,644	1,734

500-MCM feeder with 400-MCM trolley; copper resistance, 0.094044 ohms

120	.035594	.129638	2,121	2,237
110	.038829	.132873	2,070	2,183
100	.042712	.136756	2,011	2,121
90	.047458	.141502	1,943	2,049
85	.050250	.144294	1,906	2,010
80	.053390	.147434	1,865	1,967
70	.061017	.155151	1,772	1,869
60	.071187	.165231	1,664	1,755
50	.085424	.179468	1,532	1,616
40	.106781	.200825	1,369	1,444

Rail Track Total Maximum
Weight Resistance Circuit Instantaneous
Lb per Ohms Resistance, Amperes
Yd Ohms Ohms 275 V 290 V

8,500-FT CIRCUIT LENGTH

2,000-MCM feeder with 400-MCM trolley; copper resistance, 0.037471 ohms

120	.037818	.075289	3,653	3,862
110	.041266	.078727	3,493	3,684
100	.045382	.082853	3,319	3,500
90	.050424	.087895	3,129	3,299
85	.053390	.090861	3,027	3,192
80	.056727	.094198	2,919	3,079
70	.064831	.102302	2,688	2,835
60	.075636	.113107	2,431	2,564
50	.090763	.128234	2,145	2,261
40	.113454	.150925	1,822	1,921

1,500-MCM feeder with 400-MCM trolley; copper resistance, 0.047332 ohms

120	.037818	.081150	3,389	3,574
110	.041266	.085588	3,104	3,278
100	.045382	.092714	2,966	3,128
90	.050424	.097756	2,813	2,967
85	.053390	.100722	2,730	2,879
80	.056727	.104059	2,643	2,787
70	.064831	.112163	2,452	2,586
60	.075636	.122968	2,236	2,358
50	.090763	.138095	1,991	2,100
40	.113454	.160786	1,710	1,804

1,000-MCM feeder with 400-MCM trolley; copper resistance, 0.064236 ohms

120	.037818	.102054	2,695	2,842
110	.041266	.105492	2,607	2,749
100	.045382	.109618	2,509	2,646
90	.050424	.114660	2,398	2,529
85	.053390	.117625	2,338	2,465
80	.056727	.120963	2,273	2,397
70	.064831	.129067	2,131	2,247
60	.075636	.139872	1,966	2,073
50	.090763	.154999	1,774	1,871
40	.113454	.177990	1,548	1,632

500-MCM feeder with 400-MCM trolley; copper resistance, 0.099922 ohms

120	.037818	.137740	1,997	2,105
110	.041266	.141178	1,948	2,054
100	.045382	.145304	1,893	1,996
90	.050424	.150346	1,829	1,929
85	.053390	.153312	1,794	1,892
80	.056727	.156649	1,756	1,851
70	.064831	.164753	1,649	1,760
60	.075636	.175558	1,566	1,652
50	.090763	.190685	1,442	1,521
40	.113454	.213376	1,289	1,359

9,000-FT CIRCUIT LENGTH

2,000-MCM feeder with 400-MCM trolley; copper resistance, 0.035675 ohms

120	.040043	.079718	3,450	3,638
110	.043683	.083358	3,299	3,479
100	.048051	.087726	3,135	3,306
90	.053390	.093065	2,955	3,116
85	.056531	.096206	2,858	3,014
80	.060064	.099739	2,757	2,908
70	.068645	.108320	2,539	2,677
60	.080085	.119760	2,296	2,422
50	.096103	.135778	2,025	2,136
40	.120128	.159803	1,712	1,815

1,500-MCM feeder with 400-MCM trolley; copper resistance, 0.050116 ohms

120	.040043	.090159	3,050	3,217
110	.043683	.093799	2,932	3,092
100	.048051	.098167	2,801	2,954
90	.053390	.103506	2,657	2,802
85	.056531	.106647	2,578	2,719
80	.060064	.110180	2,486	2,632
70	.068645	.118761	2,316	2,442
60	.080085	.130201	2,112	2,227
50	.096103	.145219	1,881	1,983
40	.120128	.170244	1,615	1,703

Rail Track Total Maximum
Weight Resistance Circuit Instantaneous
Lb per Ohms Resistance, Amperes
Yd Ohms Ohms 275 V 290 V

1,000-MCM feeder with 400-MCM trolley; copper resistance, 0.068014 ohms

120	.040043	.108057	2,545	2,584
110	.043683	.111697	2,462	2,506
100	.048051	.116065	2,369	2,499
90	.053390	.121404	2,265	2,389
85	.056531	.124545	2,208	2,328
80	.060064	.128078	2,147	2,264
70	.068645	.136659	2,012	2,122
60	.080085	.148099	1,857	1,958
50	.096103	.164117	1,676	1,767
40	.120128	.188142	1,462	1,541

500-MCM feeder with 400-MCM trolley; copper resistance, 0.105800 ohms

120	.040043	.145843	1,886	1,988
110	.043683	.149483	1,840	1,940
100	.048051	.153851	1,787	1,885
90	.053390	.158190	1,727	1,822
85	.056531	.162331	1,694	1,786
80	.060064	.166864	1,658	1,748
70	.068645	.174445	1,576	1,662
60	.080085	.185885	1,479	1,560
50	.096103	.201903	1,362	1,436
40	.120128	.225928	1,217	1,284

9,500-FT CIRCUIT LENGTH

2,000-MCM feeder with 400-MCM trolley; copper resistance, 0.041879 ohms

120	.042267	.084146	3,268	3,446
110	.046110	.087989	3,125	3,296
100	.050721	.092690	2,970	3,132
90	.056356	.098235	2,799	2,962
85	.059671	.101550	2,708	2,858
80	.063401	.105280	2,612	2,755
70	.072458	.114337	2,406	2,536
60	.084535	.126414	2,175	2,294
50	.101442	.143321	1,919	2,023
40	.126802	.168681	1,630	1,719

1,500-MCM feeder with 400-MCM trolley; copper resistance, 0.052900 ohms

120	.042267	.095167	2,890	3,047
110	.046110	.099010	2,777	2,929
100	.050721	.103621	2,654	2,798
90	.056356	.109256	2,517	2,654
85	.059671	.112571	2,443	2,576
80	.063401	.116301	2,365	2,494
70	.072458	.125358	2,194	2,313
60	.084535	.137435	2,001	2,110
50	.101442	.154342	1,782	1,879
40	.126802	.179702	1,530	1,614

1,000-MCM feeder with 400-MCM trolley; copper resistance, 0.071793 ohms

120	.042267	.114080	2,411	2,543
110	.046110	.117903	2,332	2,460
100	.050721	.122514	2,245	2,367
90	.056356	.128149	2,146	2,263
85	.059671	.131464	2,092	2,206
80	.063401	.135194	2,034	2,145
70	.072458	.144251	1,906	2,010
60	.084535	.156328	1,769	1,855
50	.101442	.173235	1,587	1,674
40	.126802	.198595	1,385	1,460

500-MCM feeder with 400-MCM trolley; copper resistance, 0.111678 ohms

120	.042267	.153945	1,786	1,884
110	.046110	.157788	1,743	1,838
100	.050721	.162399	1,693	1,786
90	.056356	.168034	1,637	1,726
85	.059671	.171349	1,605	1,692
80	.063401	.175079	1,571	1,656
70	.072458	.184136	1,493	1,575
60	.084535	.196213	1,402	1,478
50	.101442	.213120	1,290	1,361
40	.126802	.238480	1,153	1,216

(Continued)

Maximum Instantaneous Current Values for Various DC Circuit Lengths, Conductor Sizes and Rail Weights

Rail Weight Lb per Yd	Track Resistance, Ohms	Total Circuit Resistance, Ohms	Maximum Instantaneous Amperes 275 V	290 V	Rail Weight Lb per Yd	Track Resistance, Ohms	Total Circuit Resistance, Ohms	Maximum Instantaneous Amperes 275 V	290 V
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10,000-FT CIRCUIT LENGTH

2,000-MCM feeder with 400-MCM trolley; copper resistance, 0.044083 ohms

120	.044492	.088575	3,105	3,274
110	.048537	.092620	2,969	3,131
100	.053390	.097473	2,821	2,975
90	.059322	.103406	2,660	2,815
85	.062812	.106896	2,573	2,713
80	.066738	.110821	2,462	2,617
70	.076272	.120355	2,265	2,410
60	.089984	.133067	2,067	2,180
50	.106781	.150864	1,823	1,922
40	.133476	.177559	1,549	1,633

1,000-MCM feeder with 400-MCM trolley; copper resistance, 0.075571 ohms

120	.044492	.120063	2,291	2,416
110	.048537	.124108	2,216	2,337
100	.053390	.128961	2,132	2,249
90	.059322	.134693	2,039	2,150
85	.062812	.138383	1,987	2,096
80	.066738	.142309	1,932	2,038
70	.076272	.151843	1,811	1,910
60	.089984	.164555	1,671	1,762
50	.106781	.182352	1,508	1,590
40	.133476	.208047	1,316	1,387

1,500-MCM feeder with 400-MCM trolley; copper resistance, 0.055634 ohms

120	.044492	.100176	2,745	2,895
110	.048537	.104221	2,639	2,783
100	.053390	.109074	2,521	2,659
90	.059322	.115006	2,391	2,522
85	.062812	.118496	2,321	2,448
80	.066738	.122422	2,246	2,369
70	.076272	.131956	2,084	2,198
60	.089984	.144668	1,901	2,005
50	.106781	.162465	1,683	1,785
40	.133476	.189160	1,454	1,533

500-MCM feeder with 400-MCM trolley; copper resistance, 0.117556 ohms

120	.044492	.162048	1,697	1,790
110	.048537	.166093	1,656	1,746
100	.053390	.170946	1,609	1,696
90	.059322	.176878	1,555	1,640
85	.062812	.180368	1,525	1,608
80	.066738	.184293	1,492	1,574
70	.076272	.193828	1,419	1,496
60	.089984	.206540	1,332	1,404
50	.106781	.224337	1,226	1,293
40	.133476	.251032	1,095	1,155

(Continued from p 97)

outby breaker at the No. 2 substation should never exceed 2,277 amp unless a tie breaker is installed between the substations.

If a tie breaker is added, its setting should not exceed 2,277 amp. The setting of the No. 3 substation breaker and that of the outby No. 2 substation breaker can each be increased to the capacity of each substation, if desired. However, in such cases, it would be wise to employ a totalizing overcurrent relay, controlling inby and outby breakers at the No. 2 substation, whose setting would be slightly lower than either the outby or inby breaker or the substation breaker itself. In some instances, where the substation serves only main haulage load, inby and outby breakers are not required (see USBM Bulletin 514, p 11). The No. 2 substation also serves mining load to its southeast.

Where the connecting feeders are composed of several lengths of different feeder and track, the resistance for the sections may be determined from the tables and the total divided into the system volts to determine the short-circuit capacity. This value should then be discounted by 12% to secure a reasonable circuit-

breaker setting. The following listing shows proposed settings of the circuit breakers in the other substations of the distribution system:

Connecting Substations	Distance Ft	Substation or Inby Breaker Setting, Amp	Substation or Outby Breaker Setting, Amp
1-2	8,400	No. 1, 2,000*	No. 2, 2,000*
1-5	7,400	No. 1, 2,113*	No. 5, 2,113*
2-3	7,000	No. 2, 2,277	No. 3, 2,277*
2-4	4,400	.....	No. 2, 3,477*
			No. 4, 3,477*
2-5	7,800	.....	No. 2, 2,542*
			No. 5, 2,542*
4-5	8,400	.....	No. 4, 1,711*
			No. 5, 1,711*
5-6	6,900	.....	No. 6, 2,100

Note: Where two or more different settings evolve for the same circuit breaker, the lower or lowest of the settings should be selected to assure protection against the most adverse conditions.

* Application of "tie" circuit breakers should be in accordance with the recommendations of USBM Bulletin 514. It is considered good practice to maintain the setting of a "tie" breaker at approximately one-half the setting of the higher of the two breakers it connects. Special cases may warrant use of the tables for "tie" breakers.

Power for the several active stub-end working sections of the mine is supplied from the substation tie-line circuits already mentioned. Generally, the circuit-breaker settings for these sections, in most mines, can be determined directly from the tables by selecting the current value shown for similar circuits corresponding in length and size to the ones in question.

Parallel Circuits

At the mine shown in Fig. 2, parallel haulageways are in use which requires that the additional capacity of the circuit introduced by the second parallel entry be taken into account. For example, the section nearest the No. 3 substation is approximately 2,600 ft long and comprises two parallel entries, one of which is equipped with a No. 9-section trolley wire, a 500-MCM overhead feeder and 40-lb track, whereas the other entry has No. 9 section trolley wire and 40-lb track only. To apply the tables in this instance, the total overhead circular-mil area could be considered as 1,300 MCM and the rail as 80-lb.

Since the distance is in excess of 2,500 ft, the table section for 3,000 ft should be used to determine circuit capacity. The nearest total conductor size to 1,300 MCM in the table would be 1,400 MCM. Taking track of 80-lb rail as equivalent to two tracks of 40-lb rail, the equivalent circuit capacity is found from the table to be 6,441 amp at 275 V, or 5,668 amp after applying the usual 12% reduction.

It will be noted that the theoretical short-circuit current capacity of this circuit is probably far greater than the power requirements of the section. Therefore, the circuit-breaker overcurrent setting should be maintained at an ampere value more nearly equalling the normal power requirements of the section. When this is done the circuit breaker becomes more sensitive to abnormally high resistance faults.

In applying the table to mines having a nominal DC voltage of 550, the short circuit capacity value for 275 V may be multiplied by two and used directly. If the substation voltage exceeds 550, then proceed as for 550 but correct for the difference percentage.

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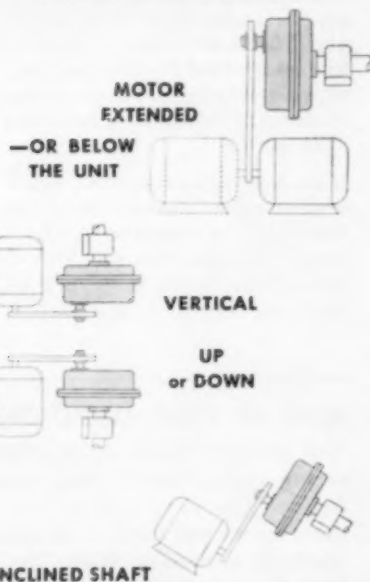
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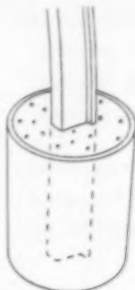
We've been asked about the Yieldable Arch



"What kind of base or footing should we use with the Yieldable Arch?"

If the bottom of your drift is definitely firm, you can set the Arches directly on the rock itself. Otherwise you should set them on footings. Wood blocks are frequently used for this purpose; so are short pieces of steel plates, channels, I-beams or other steel "leftovers."

If an acid water condition exists in your mine, it's well to set the Arch legs in concrete. A short length of pipe will serve as a permanent form in which to pour, as shown in the sketch.



SEND US YOUR QUESTIONS

You probably have other questions of a specific nature, concerning the application of the Yieldable Arch or Ring to your mine. If so, by all means send them in; we will study your questions and reply as promptly as possible. Write: Room 1041, Bethlehem Steel Company, Bethlehem, Pa.

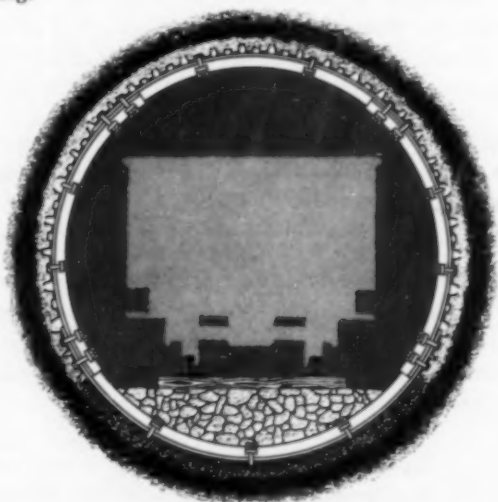
"Our mine opening has a heaving bottom. Is there any way the Yieldable Arch can help under that condition?"

For problems such as bottom heave, Bethlehem can furnish a four-piece yieldable set which is really not an arch but a Yieldable Ring, with four joints instead of the usual two found on the conventional Arch set.

The Yieldable Ring is essentially similar to the Yieldable Arch. It works on the same principle of sliding joints, is made of the same U-shaped sections, and is available for the same range of mine openings. It provides the best means of operating under pressures squeezing in from all directions.

Installation of the Yieldable Ring differs in that the two joints at the bottom of the ring should be tightened only to about 150 ft-lb, instead of the 180 ft-lb of torque normally applied. This is due to the fact that the bottom two joints usually will lie in muck, which adds measurably to the friction in the joint.

One more important point: with the Yieldable Ring, as with the Arch, lagging and blocking is necessary to fill the voids between steel and rock. Lagging should completely surround the Yieldable Ring.




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—that increases belt life,
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The "Shorty" unit is only 2 feet high!

The new "Shorty" underground conveyor featuring the new McNally Pittsburg Cradle Idler is ideally suited for use in limited working areas. Vertical supports are only 2 feet high. For extremely low clearance installations these conveyors can be made with 3" diameter rollers (instead of the standard 5"), and the average over-all height can be as little as 17" for a 36" belt, using a 30° deep trough idler construction.

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Exclusive NEW Patented Cradle Idler*



The secret of the dramatically improved performance and lower maintenance cost of this new heavy duty conveyor is the *true catenary suspension* of the Cradle Idlers. Since the rollers *rotate* on the steel rope, dangerous "loping and harmonics" cannot develop. The 5" rubber rollers, assembled on precision ground ball bearings, are prelubricated, lifetime sealed.

- Increased belt life—because full belt support is maintained under all conditions
- No creasing or cutting of belt
- Minimum maintenance

McNally Pittsburg Mfg. Corp., Pittsburg, Kansas

- ☐ Please send information on the new McNally Pittsburg belt conveyor.
☐ Have Sales Engineer call for further consultation.

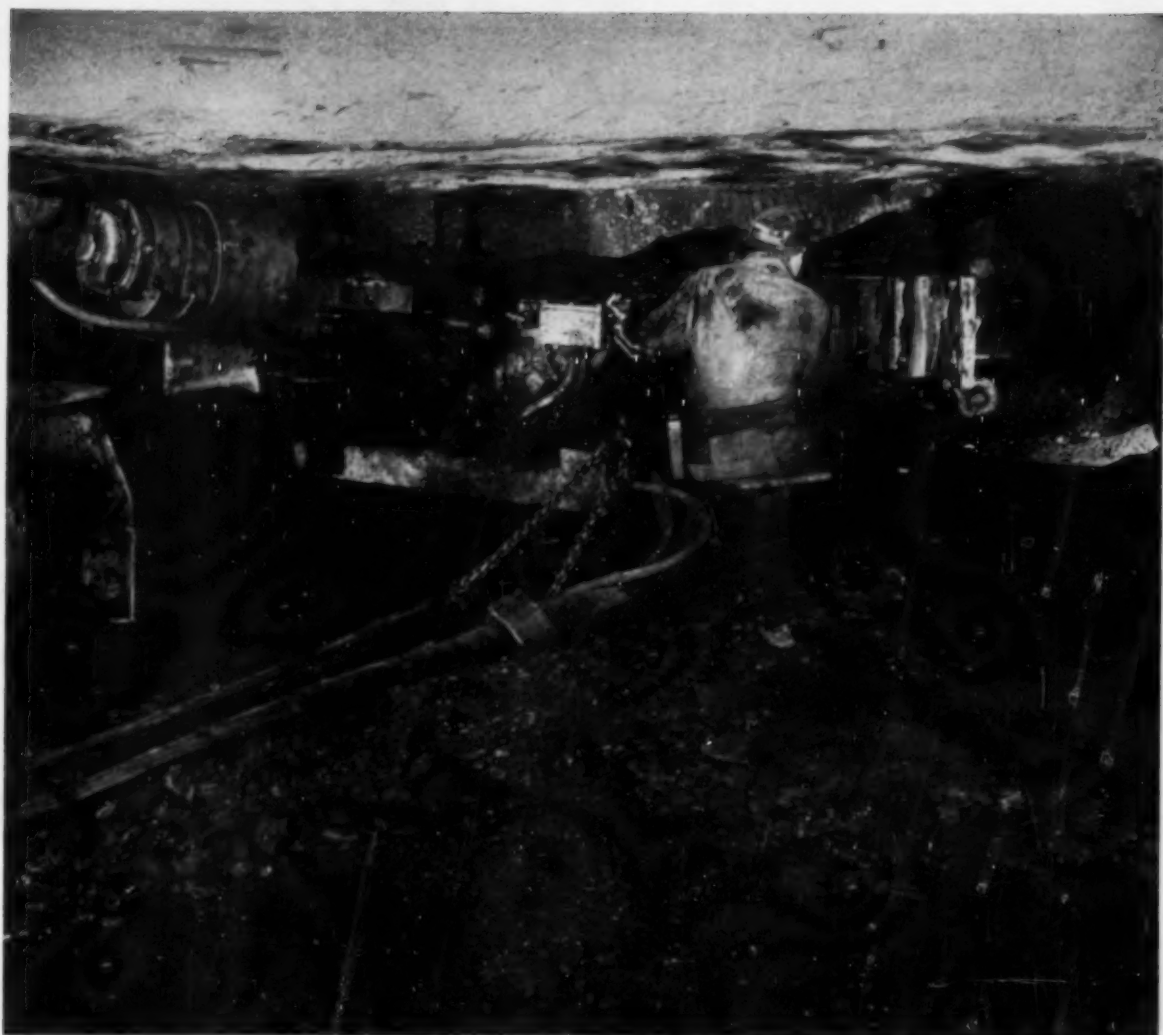
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How to reduce stop-and-go mining

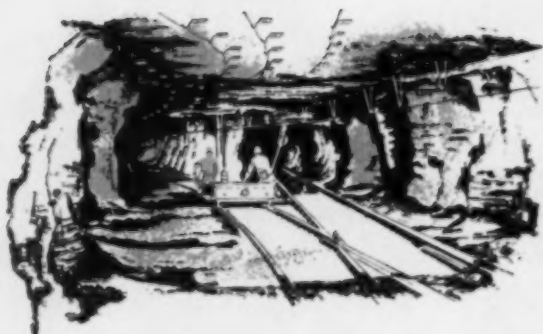
Every time a machine is out because of cable failure, what choice do you have? Either you lose production or you must subject the other equipment used to handle the load of the disabled machine to excessive wear and tear.

But now you can minimize the downtime due to cable failure of continuous mining machines, cutting machines, conveyors and loaders. With Rome portable parallel duplex power cable, you're sure of longer working periods, even under the most grueling mine conditions. Here's why:

1. An open fibrous braid around each power conductor provides 360° of balanced adhesion to the Rome 60 (neoprene) sheath.
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5. Extra overload protection is provided by heat-resistant rubber compound insulation suitable for maximum continuous operation at 75°C.

The next time you have to replace a portable mining machine cable, call your Rome Cable distributor. You'll be more than satisfied with the service Rome's cables will provide. Contact your nearest Rome Cable representative for more information—or write to Department 510, Rome Cable Corporation, Rome, New York.

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*Get instant indication
of bolt tension with . . .*

NEW YOUNGSTOWN



Youngstown VTI Mine Roof Bolts are available in $\frac{1}{2}$ and $\frac{3}{4}$ -inch diameters, 28 to 84 inches in length with $3\frac{1}{4}$ -inch rolled threads.

Youngstown Mine Roof Bolts—with either standard or VTI heads—are available with self-supporting and non-self-supporting expansion shells.

You'll find a Youngstown VTI Mine Roof Bolt to fit any roof condition encountered in today's high-production mines.

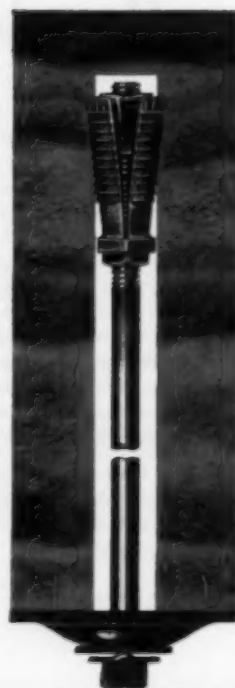
Physical properties of all Youngstown VTI Roof Bolts easily meet or exceed Specification ASTM-A-306 as outlined by the Committee on Roof Action.

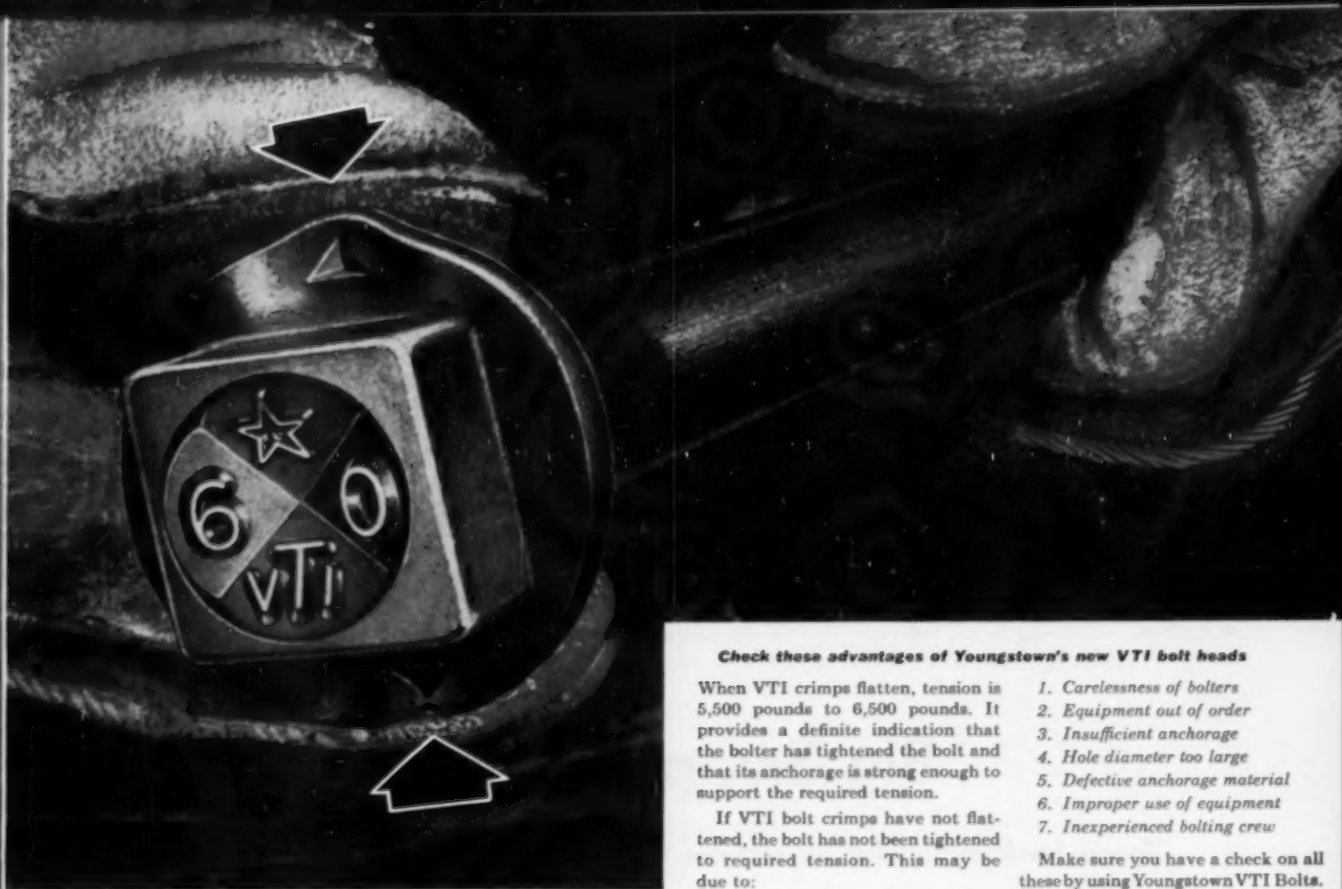
Take advantage of the highest standards of *quality*—the personal touch in our metallurgical *service* by specifying Youngstown VTI Mine Roof Bolts for your next roof-support job. For additional information, call or write today to our Home Office at Youngstown 1, Ohio.

How the Youngstown VTI bolt guarantees safe roof practice

Shown at right is a VTI Roof Bolt with a non-self-supporting expansion shell, pal nut, and a bell-type roof plate with hardened washer. When tightened with impact wrench, the VTI crimp flattens at between 5,500 and 6,500 pounds tension.

No crimp means a safe roof.





Check these advantages of Youngstown's new VTI bolt heads

When VTI crimps flatten, tension is 5,500 pounds to 6,500 pounds. It provides a definite indication that the bolter has tightened the bolt and that its anchorage is strong enough to support the required tension.

If VTI bolt crimps have not flattened, the bolt has not been tightened to required tension. This may be due to:

1. Carelessness of bolters
2. Equipment out of order
3. Insufficient anchorage
4. Hole diameter too large
5. Defective anchorage material
6. Improper use of equipment
7. Inexperienced bolting crew

Make sure you have a check on all these by using Youngstown VTI Bolts.

MINE ROOF BOLTS

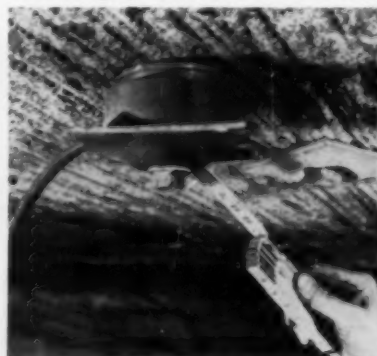
At the Nemacolin Mine of Buckeye Coal Co., Nemacolin, Pa., tests were recently conducted on $\frac{1}{2}$ -inch VTI Roof Bolts by the United States Bureau of Mines. They clearly show how the VTI feature provides a simple, fool-proof and economic means of assuring a predetermined minimum load.



VTI Bolt head showing crimping prior to loading. Air cylinder for tension testing is placed between roof and bolt plate.



Bolt head — loaded to 5,000 pounds — shows crimp beginning to flatten (note gauge reading).



At 6,100 pounds, crimp flattens completely.

*Youngstown VTI Mine Roof Bolt Patent Pending.



THE **Youngstown**

SHEET AND TUBE COMPANY • Youngstown, Ohio

Manufacturers of Carbon, Alloy and Yaloy Steel



SCRAPERS, push-loaded by big bulldozers, slice off soft sandstone overburden in 25-cu-yd bites at Swisher Coal Co. in eastern Ohio. Six units remove 1,800 to 2,000 cu yd per hour while working to banks 50 to 60 ft high.

Big Scrapers Key Flexibility

Rippers break overburden for scrapers moving 2,000 cu yd per hour. Shovel and dragline are teamed in second pit. Four-wheel-drive tractor-trailers ease haulage in hilly terrain.

SCRAPERS, BULLDOZERS WITH RIPPERS and a 7½-cu yd dragline are teamed for maximum flexibility in stripping at the Swisher Coal Co., Pomeroy, Ohio. Backing up these stripping machines, which operate in

two pits, are big rotary dry-type overburden drills for preparing blast-holes in the harder overburden and a fleet of four-wheel-drive 21-ton tractor-trailers for fast haulage in hilly terrain.

Swisher Coal mines the Ohio No. 8 seam west and north of Pomeroy where the company has access to about 35,000 acres of coal lands containing nearly 150,000,000 tons of strip coal. Nearly all of this coal lies within 20 mi of the company's barge-loading facility on the Ohio River at Pomeroy. The company currently is producing 2,500 tpd, which is shipped by barge on the Ohio River to nearby power plants.

The coal is hard and is irregular



TWIN-ENGINE rubber-mounted tractor takes over pushing job as scraper units approach top of the coal. Unit is as powerful as large bulldozer.



COMPANY PRESIDENT Ura Swisher pilots his own four-passenger plane.



RIPPER breaks up friable sandstone for scrapers. Hydraulically controlled rock breaker has three teeth which concentrate full weight of tractor for maximum penetration. Two units work ahead of scrapers. Pit width is 100 ft.

at 2,500-Tpd Strip Mine

in thickness, varying between 24 and 48 in and averaging 38 in. Sometimes sulphur inclusions and clay veins cut through the seam. These are cast aside by the coal-loading shovel as they are met.

Overburden is a mixture of sandstone and shale, with sandstone predominant. Sometimes all the cover except 4 ft of shale immediately over the coal is sandstone. Although very abrasive, the sandstone is very soft and friable and therefore usually can

be removed without blasting. The coal outcrops well above drainage in hilly terrain. In removing up to 60 ft of overburden, the company often removes the full width of narrow ridges.

Scraper Stripping

Six Caterpillar DW21 tractors pulling 25-cu yd 470 scrapers remove 1,800 to 2,000 cu yd of overburden per hour in one Swisher pit. Working

ahead of the scrapers are two Caterpillar D9 tractors with hydraulic rippers. One of the ripper tractors has a push cup on the front and is used for pushloading and ripping. The other tractor has a U-blade with hydraulic tilt and is used for clearing land and cutting ramps. If the rock becomes hard, a spare LeTourneau K30 ripper also is put in service to loosen the overburden.

When the scrapers are working some distance above the coal they



SECOND PIT has a 7½-cu-yd dragline as major stripping machine. Bulldozer and 2½-yd highlift prepare dragline bench.



TRUCK-MOUNTED vertical drill works on dragline bench, sinking 9½-in holes every 20 ft in rows 30 ft apart



COAL HAULERS include 10 tractor-trailers that carry 21-ton payload. Tractors have three driving axles.



LOADING in scraper pit is assigned to 3-yd diesel-powered shovel operating 5 days per week. Trucks carry 12½ tons.



DESTINATION of trucks is pier over floating tippie built in barge anchored in Ohio River. Coal is dumped into hopper.



LOADING BOOM juts out from floating plant to point over center of barge. Loading rate is 300 tph, can be 600 tph.

are pushed by the two D9s. As stripping approaches the top of the coal, a LeTourneau-Westinghouse Twin C rubber-mounted tractor, powered by two General Motors 671 diesel engines, is used as a pusher.

In working to banks 50 to 60 ft high, the scrapers uncover a 100-ft-wide strip of coal. On points of ridges and in favorable conditions, a strip 200 ft wide is sometimes uncovered.

Aside from providing flexibility of operation and offering the advantage of fast moves to new areas, the scraper method of stripping leaves the spoil area in a condition requiring a minimum of backfilling and leveling. Thus there is little or no work required to meet the requirements of the Ohio Div. of Reclamation.

Tandem Stripping

In the second pit Swisher combines a Caterpillar D9 bulldozer, Lima 1201 highlift shovel with 2½-yd dipper, and a Lima 2400 dragline with a Hendrix 7½-yd heavy-duty bucket for stripping. The first step in uncovering coal in this pit is making a 60- to 70-ft bench for the 2400 dragline. Either or both the D9 bulldozer and the 1201 highlift are used for this work, but the D9 usually works ahead of the highlift, cutting down the softer material. Also, if the bench is too wide for the shovel to cast directly into the pit, the shovel spoil is dropped at the edge of the bench. Then the bulldozer pushes it into the pit.

When the bench is completed, one

of two Robbins vertical rotary overburden drills is used to sink two rows of holes spaced 30 ft apart. If the bench is more than 70 ft wide three rows of holes are drilled. Holes are spaced 20 ft apart in each row.

One of the drills is mounted on an International TD24 tractor and the other on a 4-wheel-drive Kenworth truck. Both drills have 8-in by 20-ft drill-stem sections and use Hughes 9½-in bits. Only one drill, operated by two men two or three shifts per week, is needed to drill enough holes to keep pace with the dragline. The drill crew also charges the holes with ammonium-nitrate-oil mixture at the end of each shift.

Allied Chemical ammonium nitrate is delivered to the property in 80-lb



The "Autolimer" is made by the Shirley Machine Company, 725 Liberty Avenue, Pittsburgh 22, Pa.

**New neutralizer
for mine water
constructed of**



Stainless Steel

Lime and acidic mine water are mixed in the stomach of the "Autolimer." Powered only by the water that flows through it, this machine dumps measured amounts of lime into the drain water to neutralize it and prevent pollution of streams.

A constant diet of lime and acid would quickly eat away most materials. That's why the major parts of the "Autolimer" are made from Stainless Steel. Stainless resists corrosion, it's hard and abrasion resistant—therefore it gives long service in the toughest mine jobs.

If corrosion and wear have damaged equipment at your mine, replace it with Stainless Steel. It cuts maintenance and it often eliminates replacements completely. USS Stainless Steel is available through your USS representative or your local steel service center. United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

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United States Steel Supply—Warehouse Distributors
United States Steel Export Company



TRADEMARK

United States Steel



CLEAN LUBRICANTS are delivered to equipment directly from drums with individual pumps and hoses. Truck also has air compressor and impact wrench.



SPARE PARTS for stripping equipment frequently are picked up at factory and flown to mine, thus reducing downtime for emergency repairs to a minimum.

bags and stored in a trailer. On days when overburden is being prepared, the bagged nitrate is transferred to either a Dodge Power Wagon or a Jeep truck and then delivered to the drill site. In the field it is unloaded, opened and 1 gal of No. 2 fuel oil is poured into each bag. The mixture is left to set a minimum of 10 min before being poured into the holes.

If the holes are dry, the mixture is poured directly into the hole. But if holes are wet the oil-nitrate mixture is packaged in Bemis paper-lined burlap bags. Each hole receives 320 lb of the mixture.

Holes are laced with detonating fuse before the ammonium nitrate and oil mixture is poured in, and one 2x8-in Atlas RXL217 primer is used

for each 50-lb bag of nitrate. All charged holes are detonated simultaneously.

The 2400 dragline works around the clock six days a week and casts spoil on top of the material previously moved by the bulldozer and the highlift shovel. Power for the 100-ft-boom stripper is provided by a Caterpillar 397 V12 engine connected to a torsion-torque transmission. A D9 bulldozer works in the spoil area behind the dragline, leveling the area for future reclamation. This dozer also is available for road building, coal cleaning or cutting drill roads.

Loading and Hauling

In the dragline pit, coal is loaded

by the Lima highlift, usually 2 or 3 days a week. The shovel is used for the benching job on other days. A Lorain 85 shovel with a 3-yd dipper loads coal 5 days a week in the scraper pit.

To transport coal from both pits, the company has a fleet of 18 trucks. Ten of these are tractor-trailer units made up of 21-ton Fruehauf trailers pulled by Four Wheel Drive tractors. Tractors are equipped with General Motors 190-hp diesel engines and 10-speed Fuller Roadranger transmissions with 2-speed auxiliary. Tractors have three driving axles, two of which are fitted with dual wheels. Thus there are 10 wheels pulling. Trailers are end-dump units equipped with winch hoists driven from the tractor engines.

The company also has eight Ford F7 tandem trucks which carry a payload of 12½ tons. Since mining is now being done in areas farthest away from the river, coal is hauled as far as 20 mi.

Barge Loading

The company's barge-loading facilities are built into a 2,000-ton packet barge that rises and falls with the level of the river. Included in the floating plant are a 150-ton storage bin, feeders, conveyor and crusher.

Trucks are weighed as they back into dumping position on the bank above the floating plant. Coal then discharges into the 150-ton bin and is fed to a pair of 5-ft-wide inclined picking booms by two 5-ft reciprocating feeders. Two hand-pickers are assigned to each boom and a fifth man oversees loading and handling of barges.

Hand-picked coal discharges from the picking booms into a Gundlach two-stage 56-in crusher where it is broken to 1½-in top size. The crushed product drops onto a loading boom that discharges into barges. Refuse is directed to a belt conveyor, transferred to a chain conveyor and elevated to a storage bin on the shore. It is hauled back to the pit by the coal trucks.

Coal can be dropped into a barge at the rate of 600 tph but loading is now maintained at 300 tph. In single-shift operation the company loads 2,500 tons in river barges for shipment to a power plant.

The idea for the floating barge-

loading facility was born of necessity when the company's tippie burned in March, 1956. To get back into production as quickly as possible Mr. Swisher came up with the idea of building the tippie right on a barge. Since only a storage bin, feeders, picking conveyors, crusher and loading boom were needed, a 2,000-ton barge had ample floor area for the equipment. Furthermore an old concrete pier jutting out from the river bank was available not only to provide protection for the plant from river currents or ice flows, but also to serve as a solid anchorage point. With these advantages, the company decided to build the floating plant. It has been in service over 2 yr and has met every company need.

Swisher Coal Co. was founded by Ura Swisher, president, who first became interested in coal mining in 1936 when he owned a thriving chicken farm raising 20,000 broilers a year. To provide heat for the broiler pen, Mr. Swisher burned 4 tons of coal a day. Consuming this quantity of coal eventually led to his venture into coal mining.

The first step was leasing a tract of coal so he could dig his own fuel for heating the broiler pen. Soon neighboring farmers asked him to supply them with coal. This led to a modest expansion into a mine serving truck customers as well as nearby farmers. By 1949, Mr. Swisher was mining 300 tpd for neighbors and truck customers.

Success of this small deep mine prompted Mr. Swisher to try his hand at strip mining. He bought a Lima 1201 shovel as a stripping unit, Paymaster loader to load coal and Allis-Chalmers HD10 and Caterpillar D8 bulldozers as auxiliary machines. Haulage was contracted to truck owners. With this combination of machines, the company mined about 8,000 tons of coal per month. More equipment was gradually added to increase mining capacity in the next several years. Included were two more Lima 1201s, Allis-Chalmers HD-20 and HD21 bulldozers and two Compton highwall augers. These units plus the original machines were used until 1956 when the company added six LeTourneau-Westinghouse scrap-

ers. In 1957 the company added a Lima 2400 dragline, LeTourneau-Westinghouse Twin C pusher, six Caterpillar DW21-470 scrapers, D9 bulldozers, hydraulic rippers, Lorain coal shovel and Robbins rotary high-wall drills. Swisher Coal's latest step in a continuing program of improvements is the addition of the 10 Four Wheel Drive tractor-trailer trucks in July of this year.

In addition to being a successful farmer and coal operator, Mr. Swisher pilots his own Beechcraft Bonanza airplane as a hobby. He flies not only for pleasure but also uses the plane to fly in parts for emergency repairs, thus keeping downtime to a minimum. In some instances it is possible to fly to the factory for a new part and return to the mine by the time the broken part is removed from the machine.

Coal Age Annual Index . . .

The annual index of editorials, articles and news features which have appeared in the 1958 issues of *Coal Age* is bound into this issue beginning on p 168.

PRODUCER

The Wemco Mobil-Mill:

*Standard of the Heavy Media
Separation Process:
Operators' Choice — World Wide*

The choice of the Heavy Media Separation Process for profitable, premium coal production is a sound one.

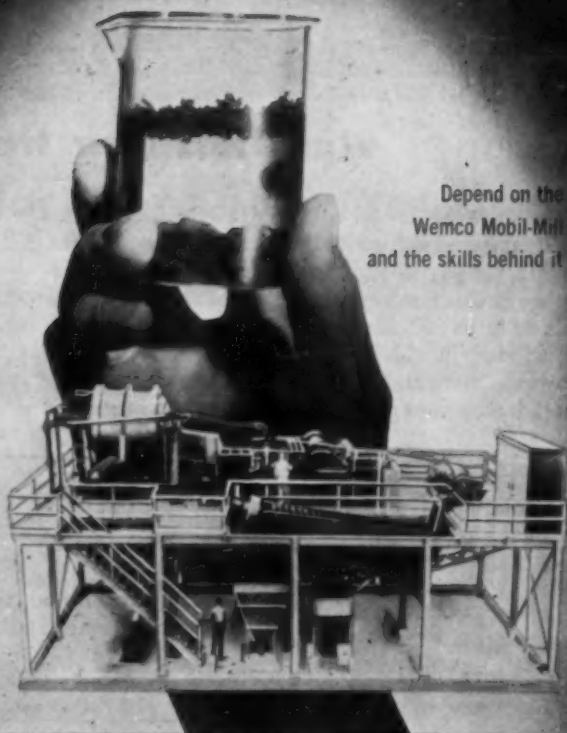
And the use of the one-man-operated Wemco Mobil-Mill for Heavy Media Separation is more and more a standard for maximum, economical production of low ash coal.

The Wemco Mobil-Mill is known for its ease and rapidity of erection — even by inexperienced personnel; proved for profitable operation from the first day as evidenced by the wide number of Mobil-Mills successfully in operation — the world over.

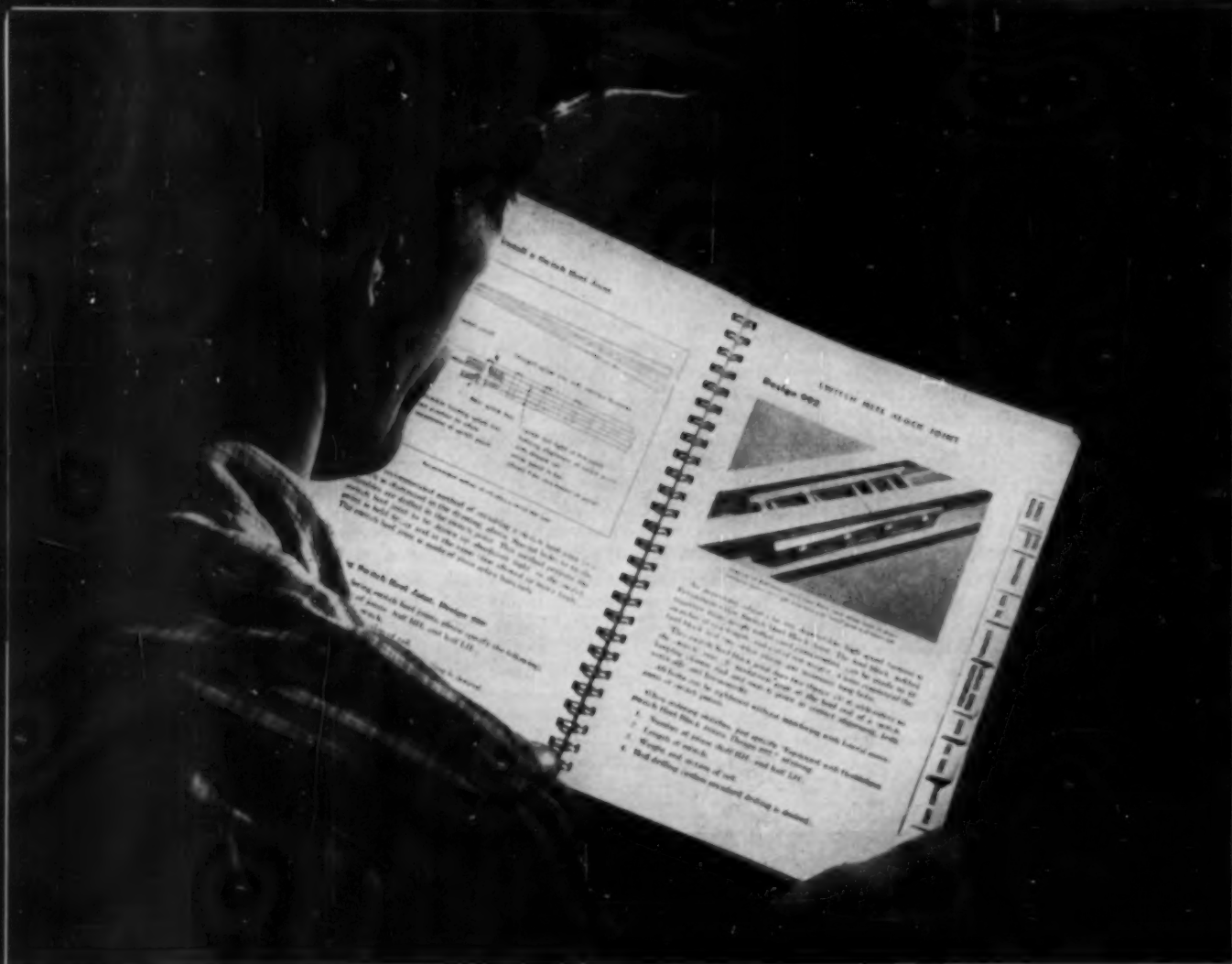
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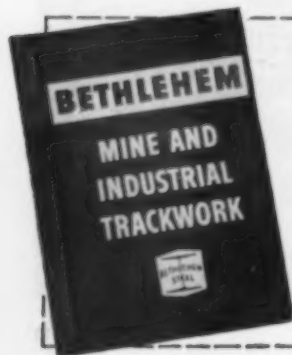
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Twin-screw diesel towboat *Humphrey*, 132' x 27' x 9'6".

New Dravo towboat for Consolidation Coal

Lower costs per ton mile, a major aim of Dravo's extensive marine research program, have been designed into the new 1,600-horsepower towboat *Humphrey*.

Now operating on the Monongahela, Allegheny, and upper Ohio Rivers, the *Humphrey* is the most advanced and efficient towboat of her draft on the inland waterways.

Here are some of the things that make her so:

New hull design with longer, leaner stern lines and broader stern tunnels produces more push with less power. Steering and flanking rudders have been reshaped and

relocated for better flow characteristics. Kort nozzle shape has been refined for greater thrust. Struts are located aft rather than forward of the seven-foot, stainless steel propellers which have been modified for more efficient use of engine power.

All exposed surfaces of the Kort nozzles, rudders and aft end of the hull are protected from corrosion by stainless steel.

The *Humphrey* is the fourth towboat in Consolidation Coal's fleet—all have been built by Dravo.

For more information, contact DRAVO CORPORATION, PITTSBURGH 25, PENNSYLVANIA.

DRAVO
CORPORATION

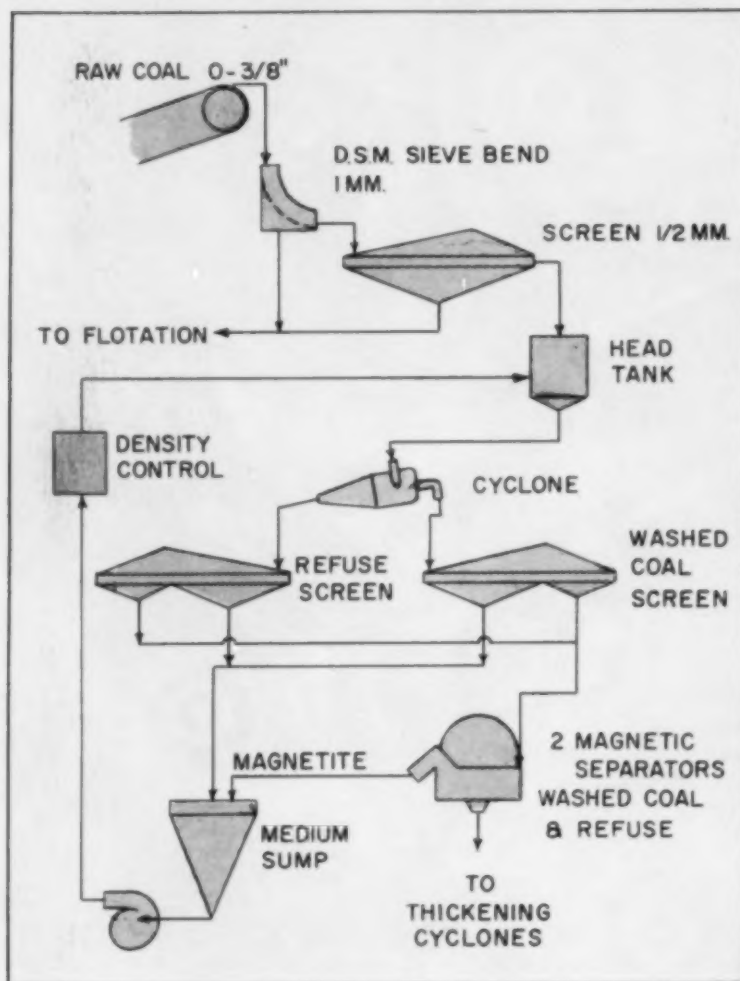


FIG. 1—Simplified cyclone washer flow-sheet, as used in Europe.

operating in The Netherlands, four in Western Germany, one in the Saar Basin, three in Belgium (with two others under construction), two in France, one in Great Britain, and one in Yugoslavia. Nearly an equal number are being constructed in several countries. The total capacity of cyclone units now in operation, which for the most part are installed in existing cleaning plants, is about 1,600 tph.

Fig. 1 shows a considerably simplified flowsheet of the cyclone washer. The Dutch State Mines "Sieve Bend," a wet gravity-type bar screen adapted to fine material, is shown in the flow diagram ahead of the main vibrating feed-preparation screen. It makes a separation at about one-half the net opening between the bars, which are placed normal to the feed flow. For that reason it has a 1-mm opening instead of the 1/2-mm shown for the vibrating screen. Sieve-bend screens also are generally used ahead of the rinse-and-drain cyclone-product screens.

Although the cyclone is widely used throughout the coal and mineral industries of the U. S. for thickening and clarifying water, and as a classifier, it has not been used in the coal industry for its second dual function: that is, cleaning the fine sizes of coal. Nevertheless, the cyclone operates both as a thickener-classifier and as a concentrator in the U. S. mineral industry.

Cyclone Washers For Fine Coal

A report on how cyclones charged with a heavy medium are used to clean coal up to 1/2 in and down to 48 mesh at plants in western Europe.

By **H. F. Yancey**
Chief, Div. of Solid Fuels Technology,
U. S. Bureau of Mines, Region I,
Seattle, Wash.

THE CYCLONE originally developed by M. G. Driessen and F. J. Fontein, of the Dutch State Mines, Heerlen,

The Netherlands, to thicken the medium used in shallow-box separators for cleaning coarse coal, and further developed by this organization during World War II as a dense-medium vessel to clean fine coal, has now come into substantial use in western Europe. Three or four cyclone washers are

European Practice

Size of coal washed in the cyclone in Europe is usually between 1/2 and 3/4 in (12 to 10 mm). Extreme fines below 35 to 48 mesh (0.5 to 0.3 mm) are removed before treatment. The undersize ordinarily is cleaned by froth flotation or may be shipped raw if removed dry before cyclone treatment. Some plants remove the fine undersize by dry screening on vibrators and occasionally with electrically heated screen cloth, but more often wet screens are used.



FIG. 2—Cyclone washery and flotation plant, Nine Mile Point colliery, National Coal Board, Great Britain.

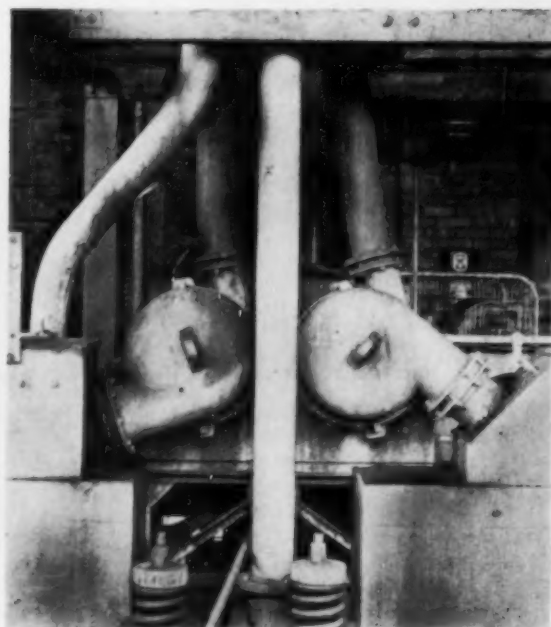


FIG. 3—Twin 20-in cyclones, with long axis 10 deg off horizontal, Nine Mile Point colliery.

A cyclone washer in the Saar operated for about a year on $\frac{3}{8}$ -in feed containing all the fine sizes but has changed to a bottom size of 48 mesh (0.3 mm) to minimize loss of magnetite.

To use the cyclone as a cleaner or concentrator the sized coal is fed as a slurry of 1 part coal to 3 to 6 parts of a suspension of fine magnetite in water. The feed to the cyclone may be supplied by a pump but, to prevent degradation, usually is mixed with the magnetite medium and flows by gravity from a constant-head tank to the cyclone. The head used varies in different plants from 15 to 30 ft, although one plant visited used a substantially higher head, reportedly because higher pressure was required for cleaning the finest sizes in the feed. This particular plant now treats a $\frac{3}{8}$ -in to 48-mesh feed.

Some European plants treat raw coal. Others use the cyclone for re-treating middlings, usually from feldspar jigs or crushed coarser material from other units. A two-product separation (washed coal and refuse) is often the goal. In some of the plants that use or market a secondary coal for fuel, however, re-treatment cyclones operating at two different densities are provided. Where this is

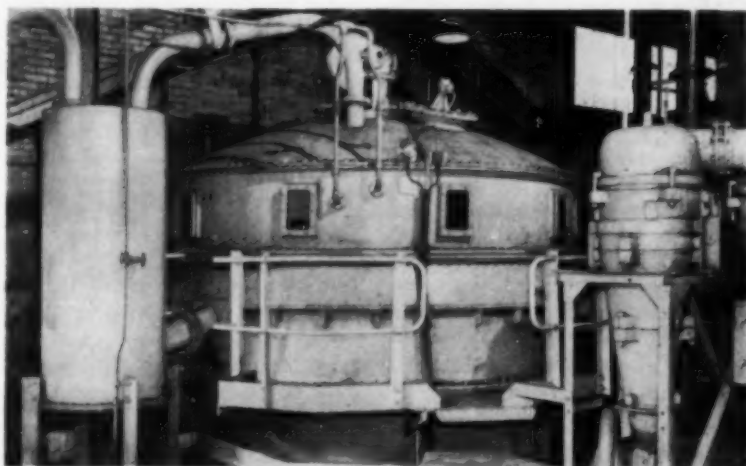


FIG. 4—Vacuum flotation unit, with thickening cyclone installed vertically at the right, Nine Mile Point colliery.

done the primary cyclones may use a magnetite medium of 1.3 to give a separation at 1.45 sp gr, and the secondary cyclones a medium of 1.8 to separate at 2.0 sp gr. The separating gravity is always 0.1 to 0.2 points higher than that of the medium.

A single cyclone is made up of 3 or 4 castings, say of white iron, bolted together at the flanges. The principal diameter ranges from 14 to 25 in. Total included angle for the conical section is 20 deg. Feed capacity of

the 14-in unit is 20 to 25 tph. The 20-in unit handles 35 to 50 tph. Cyclones may be mounted vertically or inclined just enough (10 deg) from horizontal to facilitate drainage at shutdown. With a single unit 20 in in diameter and having a length, of say, about 5 ft, the tremendous capacity per unit area of floor space occupied is evident.

Accessory equipment used with a cyclone washer is similar to that commonly used in this country with the

dense-medium washer treating coarse coal. It comprises vibrating feed-preparation and rinse- and - drain screens, magnetic separators, thickening devices and automatic controls to maintain the required medium density. With the cyclone washer smaller auxiliary cyclones are used to thicken dilute rinse medium. The Dutch State Mines gravity screen (Sieve Bend) is often used ahead of the vibrating screens to reduce the screen area required.

Great Britain

Figs. 2, 3 and 4 show the cyclone washer at the Nine Mile Point colliery, National Coal Board, near Newport, Monmouthshire, Great Britain. This plant was designed and installed by The Coppee Co., Great Britain, Ltd. After 14 mo of operation performance tests were made jointly by both organizations. W. H. Griffiths, divisional coal preparation engineer, and A. H. Dear, engineer, respectively, represented the two groups. The writer is indebted to both Messrs. Griffiths and Dear for the three photographs and the information given here.

The coal treated at this colliery is from three beds ranging from 2½ to 6 ft thick mined under about 900 ft of cover. It is medium-volatile bituminous in rank and is used for coking. The cyclone and flotation plant, treating ¾x0 raw coal, was added to the existing washery nearly 2 yr ago. Fig. 2 shows the double-bay structure housing the cyclone and froth-flotation units. Just outside the building are two thickeners, one above the other. Fig. 3 shows the two 20-in primary cyclones which treat ¾-in to 35-mesh raw coal. Coal finer than 35 mesh is cleaned in the vacuum flotation unit at the left in Fig. 4. At the

Table I—Results of Cyclone And Flotation Treatment

	Weight, %	Ash, %
Feed to cyclones.....	100	18
Washed coal from cyclones	84	6
Refuse from cyclones....	16	82
Flotation feed.....	100	17
Flotation washed coal....	85	7
Flotation refuse.....	15	75

right in this picture is a thickening cyclone.

About 85 to 90 tph is handled by the cyclones and 20 tph by the flotation unit. The density of the medium may be varied as desired, but the market requirements are met with a medium of 1.56 sp gr, which results in a separation between coal and refuse at 1.78. Under these test conditions the results are as shown in Table I. In day-to-day operation the ash in the washed coal is less than 6%.

Table II shows the float-and-sink tests at different specific gravities reported for the raw feed, washed coal and refuse. Notice that the washed coal contains only 0.3% sink in 1.80 sp gr, and the refuse has no float material at all lighter than 1.65. Moreover, between 1.65 and 1.80 sp gr, there is only 0.9%, and this fraction contains 47% ash.

These results show a very efficient, sharp separation between coal and refuse. Equally good results were reported by all six plants visited. Loss of magnetite ranged from 1 to 3 lb per ton of feed.

France

The results at a 230-tph cyclone washer in France treating a ¾x0 feed, dedusted at 1 mm, as reported by

Cerchar, the research agency of the French coal industry, are as follows:

	Weight, %	Ash, %
Raw coal.....	100	24.8
Washed coal.....	79	9.7
Middling.....	3	53.6
Refuse.....	18	83.6

The recovery efficiency shown was 99.8%. Eight primary cyclones and four secondary units, using medium densities of 1.57 and 1.75 sp gr, are employed. The loss of magnetite after 8 mo of operation is reported as about 1.2 lb per ton of raw feed. The data in Table III illustrates the effectiveness of the treatment in reducing ash content by particle size.

Saar Basin

The cyclone washer at the St. Barbara colliery, near Saarbrücken, West Germany, treats a ¾-in to 48-mesh wet-screened-prepared raw coal in 6- to 15-in cyclones at a total rate of 150 and 180 tph. This installation is under the supervision of Robert Lehner, who is in charge of coal preparation at a dozen large mines in the important Saar Basin. His examination of the cyclone as a cleaning device for fine coal started only a few years after the initial paper on this subject was presented by Mr. Driessen before the Institute of Fuel, London, Sept. 19, 1945.

At St. Barbara the mixing tank, some 30 ft above the cyclones, receives feed by flight conveyor. To minimize breakage only medium is pumped. The raw-coal feed contains 35 to 38% ash, and the washed product 6 to 7% at a yield of washed coal between 65 and 75%, depending on feed quality. The washed coal contains about 0.2% sink at 1.80 sp gr, and there is nothing in the refuse lighter than 1.45.

Table II—Specific-Gravity Analysis and Ash Content Of Cyclone Feed, Washed Coal and Refuse

Specific Gravity	Feed		Washed Coal		Refuse	
	Weight, %	Ash, %	Weight, %	Ash, %	Weight, %	Ash, %
Under 1.35.....	69.2	3.4	82.1	3.4	0	....
1.35-1.45.....	9.0	11.7	10.6	11.7	0	....
1.45-1.55.....	2.9	22.2	3.5	22.2	0	....
1.55-1.65.....	2.0	33.8	2.3	33.9	0	....
1.65-1.80.....	1.3	42.9	1.2	41.2	0.9	47.2
1.80-2.00.....	1.0	53.2	0.2	46.1	4.9	55.0
Over 2.00.....	14.6	84.2	0.1	79.4	94.2	84.3
Total.....	100.0	18.1	100.0	6.3	100.0	82.5

Table III—Reduction in Ash By Size

Size, MM	Feed		Washed Coal	
	Weight, %	Ash, %	Weight, %	Ash, %
6-10.....	52.4	25.2	42.9	9.7
2-6.....	34.8	23.8	44.7	9.3
1-2.....	8.0	23.0	10.3	10.8
0.8-1....	0.7	26.3	1.0	9.9
0.5-0.8..	1.1	27.6	0.6	10.5
Under 0.5	3.0	33.5	0.5	14.0
Total..	100.0	24.8	100.0	9.7

The medium density is maintained at 1.47 to give a separation at about 1.75. The cyclone-feed nozzle is elliptical but equivalent to a diameter of 3 in. The overflow orifice is 4¼ in ID; the underflow orifice, 3.4 in. Three 10-in cyclones are used for thickening dilute medium and four smaller ones for closing the water circuit of the feed-preparation vibrators and to provide spray water. The cyclone underflow (0.3 mm), containing 35% ash, is thickened, vacuum-filtered and used with other secondary coal as fuel in the mine power plant, which also supplies power to other mines in the area.

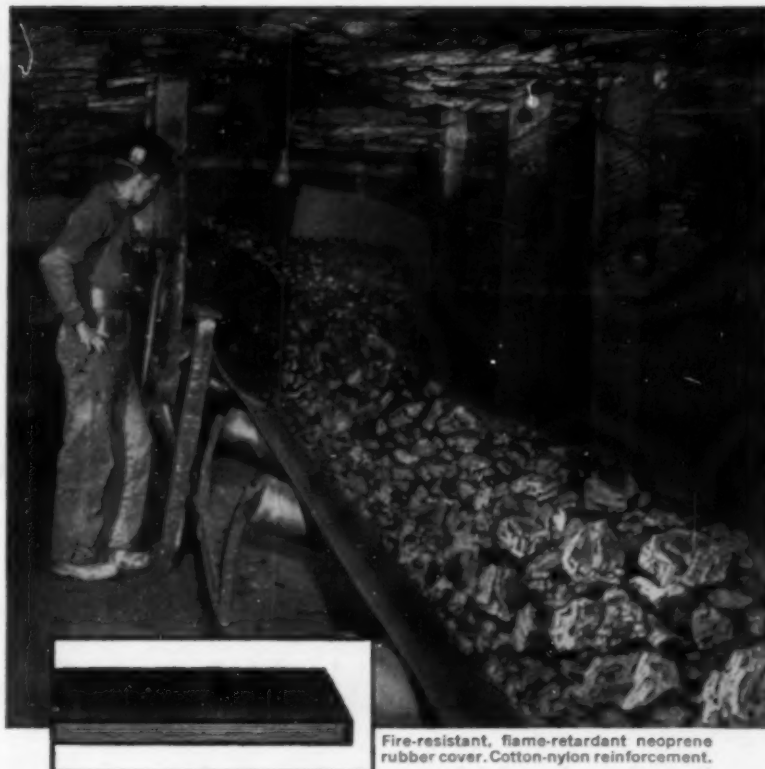
In addition to persons and organizations already mentioned, the writer also is indebted for information to Robert Van Noorbeeck, manager, Evence Copper & Co., Brussels; M. Menglers, engineer, Dutch State Mines, Heerlen, Netherlands; Franz Brinkmann, engineer, Schuechtermann & Kremer-Baum, Dortmund, Germany; W. G. Harper and W. Reed, chief and assistant chief coal-preparation engineers, National Coal Board, London, England.

Application in the U. S.

The cost of cleaning coal increases disproportionately with decrease in particle size, not only because of the enormous increase in number of particles per ton to be separated but also because of the necessity of separating solids from water and attendant high dewatering and drying costs.

The cyclone appears to be the most efficient unit known at present for cleaning fine coal down to about 48 mesh. European coal-preparation engineers consider a cyclone plant somewhat higher in first cost than a feldspar-jig plant of the same capacity but appear to feel quite generally that the increased yield of coal is compensatory, especially if the feed is difficult to treat. Coal has a much higher value in Europe than in our country. Hence, a higher preparation cost can be tolerated.

In this country preparation of metallurgical coal is becoming more difficult and there appears to be an opportunity for improvement in treatment methods. The cyclone, in combination with froth flotation, should offer more efficient preparation than that now possible at many plants. Therefore, under suitable economic conditions, the cyclone may soon find use here.



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ROOF SAFETY—Joe Taylor (left), Kaiser Steel Co.; H. J. Sloman, U. S. Bureau of Mines; Julius C. Olzer, Hanna Coal Co.; and Clinton H. Hoch, National Safety Council.



TRAINING, VENTILATION—W. H. Tomlinson (left), USBM; George H. Sambrook, section chairman, J. A. Boyle and O. S. Conn, all of U. S. Steel, and E. J. Harris, USBM.

Better ventilation, bump control and AC power are major themes at

46th National Safety Congress

Record number of delegates also hears final report on 1957-58 campaign to prevent roof-fall injuries. The report in brief: 509 fewer roof-fall injuries at participating mines during the campaign.

REPORTS on practical applications of methods and equipment and on research efforts to increase safety in coal mines highlighted the meetings of the Coal Mining Section of the National Safety Council, attended by more than 150 delegates at Chicago, Oct. 20-22. Repre-

sentatives of labor, management, government agencies and equipment manufacturers were in attendance.

Officers of the Coal Mining Section for the coming year were elected as follows:

Chairman—L. H. Johnson, health and

safety engineer, U. S. Bureau of Mines, Pittsburgh, Pa.

First vice chairman—Joshua Smith, director of safety, Eastern Gas & Fuel Associates, Mount Hope, W. Va.

Second vice chairman—J. D. Reilly, vice president, Hanna Coal Co., Cadiz, Ohio.

Secretary—H. F. Weaver, chief, coal-mine inspection branch, U. S. Bureau of Mines, Washington, D. C.

Following are abstracts of the reports and papers presented at the technical sessions:

The Bump Problem at Sunnyside and



SAFETY RESEARCH—C. S. Szekely (left), Bituminous Coal Research; R. S. James and Chairman-Elect L. H. Johnson, both of the Bureau of Mines.



MR. SAMBROOK, retiring chairman of Coal Mining Section, receives plaque in recognition of services from C. A. Ferguson, UMW.

What Has Been Done to Protect Against It, by John Peperakis, mine manager, and Joe Taylor, mine engineer, Kaiser Steel Corp., Sunnyside, Utah. (Presented by Mr. Taylor.)

Natural conditions contributing to bumps in the Carbon-Emery County coalfields in Utah include (1) deep cover up to 2,500 ft in thickness, (2) extremely rough surface topography resulting in great changes in pressure over short spans, (3) massive sandstone strata above and below the seams and (4) tectonic movements in connection with extensive faulting in the area. Hoisting slopes and parallel manways and airways are particularly vulnerable because of large worked-out areas on either side of protective barriers.

Modifications to the mining system have reduced the frequency of bumps. These modifications include the cutting of blocks or pillars of uniform size and the avoidance of connecting rooms and haulage slants wherever possible to eliminate the presence of odd-shaped blocks during pillar recovery operations. Other steps, designed to provide maximum protection for personnel, are as follows:

1. Triggering of stressed pillars by augering with a 24-in unit or by drilling 2½-in holes and shooting the pillar. The latter method was found to be preferable because the coal bound the larger auger and more men were required to operate the auger than to perform continuous-mining operations. Thus more were exposed in the triggering process than in actual mining.

2. Maximum roof support is stressed. Cribbs and large timbersets are used in combination with roof bolting.

3. Yieldable arches are coming into wider use to protect main openings, and so far seem to be doing an excellent job. In some areas, backfilling of open areas is done to reinforce the standing blocks of coal.

4. Wherever possible, shafts in thinner cover will be used to replace slope airways.

Roof Control With Continuous-Miner Operation, by Julius C. Olzer, safety director, Ireland Mine, Hanna Coal Co., Moundsville, W. Va.

Operations at Ireland mine, in the 62-in Pittsburgh No. 8 seam, are conducted under a tender drawslate that varies in thickness from 0 to 48 in. Above the drawslate is a strong roof coal from 12 to 24 in thick. Strata above this roof coal is a mixture of weak shales from 8 to 10 ft thick. Above these is a thick layer of limestone which is strong and uniform.

Ripper-type continuous miners are equipped with bolting drills at each side, and the roof jacks have been

INDUSTRY MEETING— A Special COAL AGE Staff-Written Report

equipped with a length of 60-lb rail to provide a crossbar support ahead of the operator and roof bolters. Roof bolts are 6 ft long and ¾ in in diameter. They are installed simultaneously, one on each side of the machine, through 2x8-in by 12-ft hardwood plank.

Bolts are set 8 ft apart across the 15-ft rooms and in rows 4 ft apart as the machine advances. Proper blocking between the plank and roof is of vital importance to insure good support.

Much attention is given to the size of finishing bits. Have found in a few instances that bits stamped 1½ in would actually be slightly larger. It is almost impossible to tighten roof bolts when holes are only a fraction of an inch oversize. Every finishing bit on the property was gaged and oversize bits were refinished to size. Other factors that may lead to oversize holes are (1) cutting edges on bit not of equal length and (2) unequal helical clearance angles, spiraling of the bit and consequent reaming result in oversize holes in which expansion shells cannot take a firm grip.

In finishing crosscuts, the miner is advanced through the opening to permit the bolters to install roof support all the way to the intersection. When places are stopped blind, the place is narrowed down to a width of about 5 ft from the original room width of 15 ft. Safety posts are set in this non-bolted area to permit inspections to be safely made.

Results of National Campaign for Prevention of Roof-Fall Injuries, by Clinton H. Hoch, staff representative to coal mining section, National Safety Council, Chicago, Ill.

Final enrollment in the campaign included 1,214 mines, of which 342 mines submitted all necessary reports by Sept. 10, 1958, when final tabulations were made. The results show that there were 509 fewer injuries charged to falls of roof in these mines during the campaign than during the comparable base period. This is a 38% reduction in number of injuries.

The existence of the hazard is common knowledge. How to prevent virtually all the injuries caused by falls of roof also is common knowledge. When we compare public opinion toward industrial accidents today with opinion of 40 to 50 yr ago, we can imagine the day when the public's attitude will be potent enough to prohibit an excessively high accident rate in any industry. The trend today is in the right direction, and we have a compelling need to

strengthen and magnify that trend. [The Coal Mining Section voted to petition the National Safety Council to appropriate funds to continue the campaign.—Ed.]

Fundamentals of Coal Mine Accident Prevention, by W. H. Tomlinson, training administration officer, U. S. Bureau of Mines, Pittsburgh, Pa.

The course on fundamentals of coal-mine accident prevention is a new approach by the Bureau of Mines to a solution of the human problems in safety. Purpose of the course is to train supervisors to teach and instruct workmen. It gives supervisors a basic understanding of what accident-prevention is, what it accomplishes and how it is achieved. The course is conducted by the illustrated lecture method and can be completed in 16 hr.

The value of visual aids in communicating information cannot be over-emphasized. This new course employs the flannel-board technique, since most learning is assimilated through eyes and ears.

To be effective, a safety program must be dynamic, subject to change as conditions or circumstances warrant. The flannel-board approach offers unlimited possibilities for making adjustments.

The Control of Mine Ventilation Utilizing Multiple Main Fans, by J. A. Boyle, chief mine inspector, and O. S. Conn, ventilation engineer, Frick Dist., U. S. Steel Corp., Uniontown, Pa.

Robena mine, U. S. Steel, includes more than 56 mi of main intake airway of which 54 mi are primary haulage roads. There are 155 mi of return air courses and 53 mi of bleeder entry. One blowing fan and seven exhaust fans at this property provide a volume of 2,300,000 cfm, which is 20% in excess of normal air requirements. These fans exhaust 6,000,000 cu ft of methane per day. The multiple-fan installation at Robena is designed to provide two-split section ventilation; fire door and regulator arrangements to afford smoke-free escape routes in the event of emergency; an 0.5% maximum allowable methane concentration in the return of any air split, and a minimum allowable air flow of 10,000 cfm on haulage roads.

Aside from these safety features, the reserve capacity in a multiple-fan system affords the opportunity to minimize the consequences of rare but significant fan failures.

The Robena system eliminates doors in main intakes. However, separation doors are provided at strategic locations in main returns to positively establish the direction of air flow to the various fans.

Periodic ventilation surveys are run

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with each fan stopped to determine, by actual air measurement, the resultant effect on the air distribution. Furthermore, prepared plans of action have been formulated to be followed to the letter in case of failure of any of the fans.

Application of Small Blower Fan on Continuous Miner to Aid Face Ventilation, by E. J. Harris, mining health and safety engineer, U. S. Bureau of Mines, Pittsburgh, Pa.

Line brattice does a reasonable job of directing fresh air to the tail of a continuous miner. However, boring- and ripper-type machines restrict clearances to such an extent that only a small volume of air actually reaches the face. Recent tests in the field prove line brattices to be very ineffective in ventilating the immediate face. Moreover, numerous ignitions have occurred in places assumed to be well ventilated with the use of line brattice.

The idea of a small hydraulically-driven blower or diffuser incorporated in the design of the continuous miner has been advanced. The Bureau of Mines tested such a device on a mock-up model of a miner. Comparative tests were conducted, using blow and exhaust brattices alone, and each in conjunction with the small auxiliary blower on the model of the miner.

The blower was effective in diluting methane at the immediate face. It was necessary to keep brattice lines up to the face to provide a ready supply of fresh air to the intake of the blower.

Research on Dust Suppression by Foam at Working Faces, by C. S. Szekely, assistant director, mining development committee, BCR, Huntington, W. Va., and G. L. Alston, development engineer, Mine Safety Appliances Co., Pittsburgh, Pa.

The project of controlling dust at the face through the use of foam is a joint venture of BCR, Union Carbide Chemicals Co. and Mine Safety Appliances Co. In early experiments it has been noted that when the foam is introduced at the bits of a ripping-type continuous miner and carried into the cut by the bits, very little air-borne dust is in evidence. However, the presence of the foam in the working places has created difficult working conditions.

Stabilization of the foam is one of the problems to be solved. Other unknowns involve costs, effects on preparation processes and effects on face ventilation.

Safety Aspects of AC Power in Underground Mining Operations, by A. C. Lordi, Westinghouse Electric Corp., Pittsburgh, Pa.

The recent trend toward the use of three-phase AC power underground attests to the advantages of this system.

While the hazards of shock and electrical ignition of fires still exist, the three-phase AC system lends itself to better control of these hazards.

Factors to be considered in the choice of a neutral grounding resistor are:

1. The resistor should be insulated for line-to-line voltage to provide a margin of insulation.
2. The resistor should be continuously rated so that it may continue to function if the ground fault is not immediately isolated.
3. The resistor should be constructed of corrosion-resistant materials and have welded connections to insure operation under adverse conditions.
4. The resistor value in ohms should be high enough to limit frame-to-ground voltage to safe values and yet be low enough to allow the flow of sufficient ground fault current to be selectively relayed with adequate margin by the feeder breaker relays.

One importance of ground-wire continuity has prompted the use of monitoring schemes, such as the following:

An alternating current of extremely low potential is circulated over a cable pilot wire to the connected equipment frame, back to the ground point at the neutral resistor. Any open in the ground or pilot wires causes this current to cease flowing. This interruption is suitably relayed to cause tripping of the circuit breaker.

Progress Report on Continuous Methane Measurement for Alarms and Power Shutoff, by R. S. James, chief, Branch of Mechanical-Electrical Testing, U. S. Bureau of Mines, Pittsburgh, Pa.

Active research now is underway to develop a continuous methane detector which will provide a visible or audible signal at one concentration of methane and serve to shut off power to face equipment at a higher concentration. At least one manufacturer soon will submit a model to the Bureau for testing according to the Bureau's design suggestions. A schedule now is being written to govern procedures.

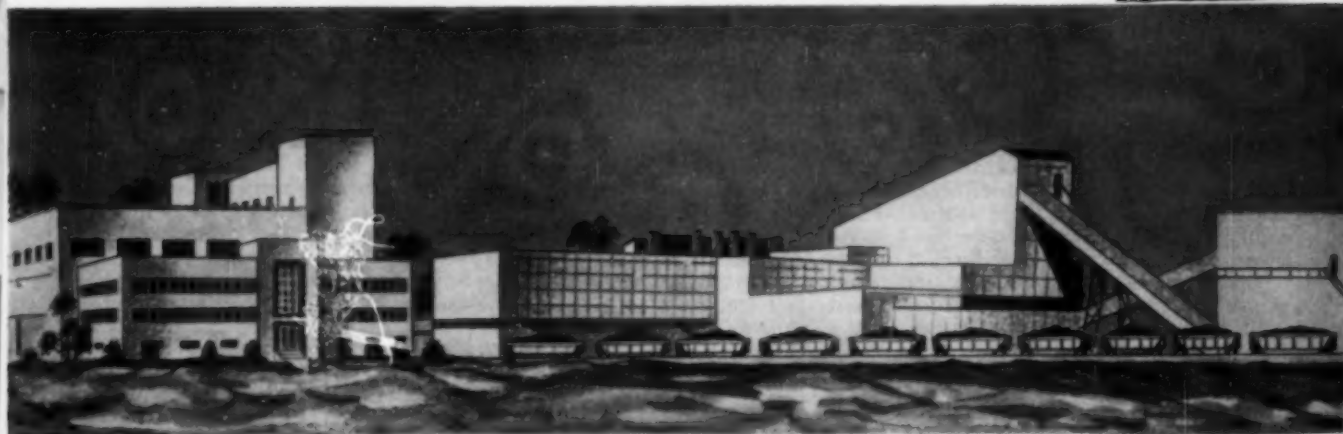
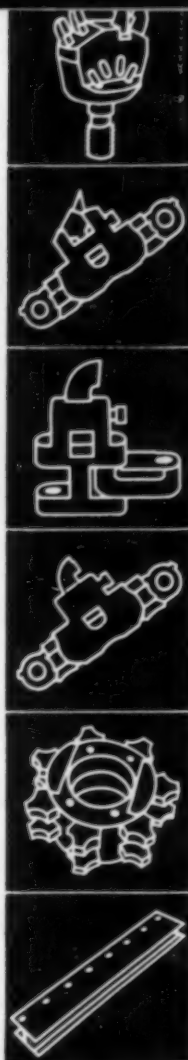
On the question of how continuous methane monitoring will affect mining, the answer is that it will force maintenance of better ventilation. The early warning signal will give the foreman or other officials an indication of dangerous lack of ventilation and will provide a more complete picture of methane liberation.

It is hoped also that the provisions for power shutoff will give much needed warnings of trailing cable faults, thus eliminating many cable hazards. The research still is in its early stages. Manufacturers and the Bureau of Mines are convinced that the problem can be solved, bringing the mining industry one step nearer the elimination of gas ignitions at working faces.

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METHODS, EQUIPMENT—G. M. Wilson (left), IMI secretary; J. W. McDonald, Old Ben Coal Corp.; W. A. Weimer, Peabody Coal Co.; J. D. Reilly, Hanna Coal Co.; Elmer Citron, Pittsburg & Midway Coal Mining Co., and Gerald von Stroh, Bituminous Coal Research.



MINE VENTILATION—George Eadie (left), assistant professor of mining, University of Illinois; C. C. Conway, National Mine Service Co.

Delegates to 66th Illinois Mining Institute meeting explore . . .

Coal's Methods and Problems

Ventilation, transportation, automation are important subjects at recent Springfield convention.

The coal industry's responsibilities in preventing pollution of public waterways also aired.

EQUIPMENT APPLICATIONS at mining properties, fuel requirements for modern power plants and the need for immediate anti-pollution steps were major topics brought to the attention of more than 400 men in attendance at the annual meeting of the Illinois Mining Institute at Springfield, Ill., Oct. 24. H. C. Livingston, vice president, Truax-Trauer Coal Co., Chicago, and 1957-58 president of IMI, presided at the business session and at the evening banquet. The institute elected A. G. Gossard, vice president, Snow Hill Coal Corp., Terre Haute, Ind., to succeed Mr. Livingston as president.

Honorary life memberships were voted to Gilbert Cady, formerly chief of the Illinois Geological Survey, and to D. W. Buchanan, chairman of the board, Old Ben Coal Corp., Chicago. M. D. Cooper, retired director of mining engineering education, National Coal Association, was presented a gold watch as a token of appreciation for his efforts in promoting mining engineering education.

Chairmen of the technical sessions were C. C. Conway, National Mine Service Co., Nashville, Ill., at the morning

session, and J. W. McDonald, vice president—engineering, Old Ben Coal Corp., Benton, Ill., in the afternoon.

Abstracts of the papers presented at the technical sessions are as follows:

Fuel Requirements for Modern Power Plant Operation, by A. T. Secor, superintendent, Shawnee plant, T. V. A., Paducah, Ky.

The 100,000 kw generating units now in operation consume up to 15,000 tons of coal per day. It can be expected that new larger facilities now on the boards will require from 20,000 to 30,000 tpd. The mechanical handling of coal in these large quantities is a matter of increasing concern. In many instances the utility companies will be primarily interested in having available an adequate supply of condensing water. The design of the plants will be such that wide ranges in coal quality and sizing can be accommodated.

INDUSTRY MEETING— A Special COAL AGE Staff-Written Report

Stockpiles at Shawnee contain up to 1,000,000 tons of coal, which is sufficient to permit from 60 to 90 days' operation at rated capacity. Special measures in stockpiling include the construction of dikes around the stockpiles to prevent erosion. The stocking-out conveyor at Shawnee is equipped with an elevating discharge boom which can load directly into the reclaiming scrapers, thus eliminating one pick-up of coal.

Users of coal always hope for dryer coal and perhaps better blends to insure some measure of uniformity. Furthermore, the need for huskier barges is becoming apparent as more and more coal is shipped on inland waterways.

As for the future, generating capacity in 1980 will be an estimated 358 million kw, against 165 million kw in 1960. This would indicate a market in power generation for 459 million tons of coal in 1980.

Fuel for Power Plants, by George Rice, chief mechanical engineer, Electric Energy, Inc., Joppa, Ill.

Proper selection of coal on bases other than cost alone is increasingly important at large plants which may consume up to 3,000,000 tons per year. One of the most important considerations at some plants is a need for coals containing a minimum of corrosive constituents.

Corrosion of boiler tubes became a major problem at Joppa. Extensive tests were conducted to find causes and remedies for this condition. The solu-



M. D. COOPER receives watch from Dr. Thomas Read, Univ. of Illinois, in recognition of efforts as educational director of NCA. Looking on are Mr. Wilson; H. C. Livingston, IMI president. Mr. Cooper recently retired as director of mining engineering education of NCA.

tion at this stage is to use shields on the tubes to prevent accumulations of corrosive slag and to select coals having high-fusion ash.

Ventilation Practices in Illinois Coal Mines, by George Eadie, assistant professor of mining engineering, University of Illinois, Urbana, Ill.

One of the mining research projects at the University of Illinois is devoted to a survey of the utilization of ventilating air in the coal mines of the state. The pace of operations is much faster now since the advent of continuous mining and the necessity for adequate ventilation grows in the same measure.

Field studies at a number of mines reveal that average efficiency of the ventilation systems at these mines is only about 50%. One-line drawings of volume surveys show that in one instance 64% of 47,600 cfm was lost in one split between the spitting point and the working faces. Other examples showed losses of a similar magnitude. There is no proof of what happens to fugitive air, but indications are that leakage through stoppings is the primary avenue of loss. Better construction of stoppings is the obvious need.

Auxiliary fans at the face may result in excessive recirculation if sufficient volumes of air are not made available to the fans.

Water Pollution and Your Responsibility, by Henry F. Hebley, research consultant, Consolidation Coal Co., Pittsburgh, Pa.

Because of a growing need for water of high quality, eight states have joined in compact as the Ohio River Valley Water Sanitation Commission (ORSAN-

CO) in order to bring about a reduction of pollution in the Ohio and its tributaries.

ORSANCO has congressional approval of its organization and purposes and its constitutionality has been established in a test case. The commission has worked cooperatively with industry advisory groups, but it does have the legal power to require compliance with its rulings.

One result of the work of the commission is the considerable increase in municipal sewage treatment plants along the Ohio River. ORSANCO now has an engineering committee looking into the problem of acid mine drainage. As of now, a list of possible remedies for such drainage has been prepared. It appears that more stringent rules may be forthcoming.

The coal industry also must be concerned with the problem of pollution by the introduction of suspended solids into waterways. One proposed standard is to limit this form of pollution to a maximum of 1,000 ppm. Such standards can be met, but only at a price. The coal industry must take greater interest if punitive rules are to be avoided.

Operation of River King Mine, by W. A. Weimer, chief engineer, Peabody Coal Co., St. Louis, Mo.

Accumulation of extensive reserves was the major reason for the merger of Peabody and Sinclair interests in the development of River King mine. Economical mining and transportation on a large scale were required, if the markets available in the area were to be captured. High rates for rail transportation had prohibited exploitation of the coal deposits at Freeburg, Ill., in the past. Therefore, the new operators selected river shipment and a company-

owned rail link between the mine and the loading dock.

Operating data on the 70-yd shovel at River King is as follows:

In the first 13 mo of operation, the shovel moved 20 million yd of overburden. The machine worked 6,217 hr and was delayed 3,184 hr. Electrical failures caused 17% of the delays; mechanical failures caused 52%, and miscellaneous reasons caused 31% of the delays. Average performance was the removal of 3,266 cu yd per hr at a power consumption rate of 0.4524 kw-hr per yd.

Pit design is very important in achieving maximum production from such large units. Peabody engineers prepare pit maps at a scale of 100 ft to 1 in, showing both surface and coal contours. This information is used in planning approaches to hills to insure adequate room for spoil.

Other features at River King are the cable car haul, which is safer than gravity systems in handling railroad cars, and the pumping of 5x0 preparation plant refuse. (See *Coal Age*, January, 1958, p 76.)

Economics of the Large Mine Car, by J. D. Reilly, vice president, Hanna Coal Co., Div. of Consolidation Coal Co., Cadiz, Ohio.

Ireland mine of the Hanna Coal Co., near Moundsville, W. Va., is being developed to supply 100 million tons of coal to a single customer, a power plant serving an integrated aluminum facility. When fully developed, the mine will require a main-line haul of from 16 to 20 mi. Economic studies of various transportation systems led Hanna officials to select track haulage employing large mine cars. This decision initiated an extensive in-company research program to arrive at final designs for the cars.

The steel cars at Ireland are 28 ft long and 543 cu ft in volume. Pusher plates have been attached at 14-ft intervals on the cars to accommodate the car spotters in use at the mine. Specially designed cast-steel wheels of 16-in diameter are used, and special pains have been taken to insure that pairs of axles on individual trucks are absolutely parallel. The axles are sprung at center points.

Design of the cars is such that there are fewer parts per unit of payload, thus reducing maintenance requirements. Ten aluminum cars are in service at Ireland to provide comparative data.

Advantages of Overland Belt Transportation, by Elmer Citron, mechanical engineer, Pittsburg & Midway Coal Mining Co., Pittsburg, Kan.

In planning for overland belt transportation, the factors which must be

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taken into consideration are tonnage to be handled, size of coal, character of terrain, life of the mine and distance to be traversed. There are still some unknowns in belt design; however, co-operative research at Penn State and other laboratories has been helpful in establishing wider parameters.

Among the advantages of belts for overland transport are the following:

1. High capacity—36-in belt at P&M's Paradise Collieries in western Kentucky carries 132 tpm.
2. Flexibility—can follow terrain on grades up to 30%.
3. Simple control—provisions for sequence starting and protective devices have been developed to a high degree.
4. Quiet operation—a very important consideration in negotiating for right-of-way.
5. Minimum operating labor—normally one man per mile is sufficient.
6. Initial cost is low.

The clean-coal belt at P&M's DeKoven mine, Sturgis, Ky., (see *Coal Age*, June, 1957, p 74) was installed at a total cost of \$84 per ft. The raw-coal belt, which required less support structure, was installed at a cost of \$70 per ft. At the company's newer Paradise Collieries there was more of an investment in earthwork and grading to eliminate some support structure. As a result, the Paradise installation cost \$54 per ft.

Automatic and Remote Control Mining, by Gerald von Stroh, director, mining development committee, Bituminous Coal Research, Inc., Huntington, W. Va.

On the matter of transportation, it may be possible to supplant both belts and mine cars with a system of trolley-powered monorail conveying. This is one example of how mining techniques may have to change to suit the day when 25,000 men will mine the predicted 1 billion tons per year.

Changes in the corporate structure of the industry are causing changes in the technology. Mergers within the industry have provided the necessary capital for investment in modern equipment. The capabilities in some of this equipment are now outrunning human responses, which creates a need for automation, as differentiated from remote control. Remote control still requires constant human attention. However, remote control is the first step toward automation.

The purposes of automation are to (1) provide quality control, (2) replace human decisions with automatically actuated decisions, (3) provide automatic maintenance and (4) increase productivity per unit of investment. In the areas, the quality of staff work will make the difference, and right now competent staff men are needed in industrial engineering, operations research and selection and training of personnel.

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VENTILATION—John Kalasky (left), E.G.&F.A.; D. C. Ridenour, Olga Coal Co.; Leonard Sargeant III, Pocahontas Fuel Co., Inc.; John B. Kebblish, Mountaineer Coal Co.; Harold Suter, Christopher Coal Co.; Stephen Krickovic, Eastern Gas & Fuel

Ventilation for Continuous Mining Major Topic at White Sulphur

How to solve the gas problem in continuous and conventional mining leading program subject at joint AIME-West Virginia Institute meeting. Other topics included automation and energy for the future.

INDUSTRY MEETING— A Special COAL AGE Staff-Written Report



**ENERGY FOR TOMORROW—
Ivan A. Given, Coal Age.**

TWO VENTILATION SESSIONS representing, among other things, a major contribution to the art of meeting gas problems with continuous miners, featured the joint meeting of the West Virginia Coal Mining Institute and the Central Appalachian Sec. of the American Institute of Mining, Metallurgical and Petroleum Engineers, White Sulphur Springs, W. Va., Oct. 31-Nov. 1. Another session on automation, a luncheon discussion of the future of coal in the energy picture and a dinner discussion of tensions and how to avoid and handle them, were additional events. The dinner speaker was Dr. E. J. Ryan, medical superintendent, E. I. du Pont de Nemours & Co., Inc., Belle, W. Va.

Chairmen for the sessions were:

Ventilation I—H. E. Mauck, general superintendent, Olga Coal Co., Coalwood, W. Va., and Stephen Krickovic, director of engineering, Eastern Gas & Fuel Associates, Pittsburgh.

Ventilation II—R. G. Lazzell, development and research engineer, Island Creek Coal Co., Huntington, W. Va., and Harold Suter, vice president, Christopher Coal Co., Morgantown, W. Va.

Automation—John L. Schroder Jr., general superintendent, U. S. Steel Corp., Lynch, Ky.

Luncheon session, H. O. Zimmerman, manager of coal properties, Inland Steel Co., Wheelwright, Ky.

Dinner session, George McCaa, general manager, Hanna Coal Co., Moundsville, W. Va.

Members of the ventilation panel functioning during the ventilation sessions, in addition to Messrs. Mauck, Krickovic and Suter, were: Gene Linkous, director of safety, Island Creek Coal Co., Holden, W. Va.; Leonard Sargeant III, ventilation engineer, Pocahontas Fuel Co., Inc., Pocahontas, Va.; and John B. Kebblish, general superintendent, Mountaineer Coal Co., Fairmont, W. Va.

"Section Ventilation for Goodman Boring-Type Miner," John D. Kalasky, ventilation engineer, Eastern Gas & Fuel Associates.

Steady-rate gas emission at, on occasions, very high rates, characterizes continuous mining in comparison with mining of the past, with only occasional surges from caving in pillaring and the like.

Concrete-block stoppings and canvas line curtains and checks are used with the eight boring-type miners, the first of which was installed in 1954. Thus, the materials are the same but air volumes have increased and continued stress is necessary on precautions in dealing



Associates; H. E. Mauck, Olga Coal Co.; William Poundstone (left in photo above), Christopher Coal Co.; Gene Linkous, Island Creek Coal Co.; L. D. Ellison, Island Creek Coal Co.; and D. Wiebe, Joy Mfg. Co.



AUTOMATION—John C. Kneiling, staff of Theodore J. Kauffield (left); John L. Schroder Jr., U. S. Steel Corp.; Gerald von Stroh, Mining Development Committee, BCR; Earl Berry, Mine Safety Appliances Co.

with steady-type gas emissions ranging from 4 to 170 cfm at the face.

As the miner advances the brattice-man brings the canvas along behind. In development, the line is kept to within 16 ft of the face, or up to the position of the miner operator. Extra canvas in a length is stored on the miner so as to be readily available. Since a pickup loader is employed, the lower edge of the canvas is tacked up on the rib to prevent interference and make a triangular opening with an area of about 10 sq ft.

The line is installed on the intake side, which brings in the problem of dust being carried back to the operator and the men behind him. Consequently, dual controls have been installed to put the operator in a more favorable position.

An alternative is to bring the air up on the wide side but this reduces velocity and makes it more difficult to sweep the face properly.

Narrow vs. Wide-Side Intake, Mr. Krickovic.

To emphasize Mr. Kalasky's point, a satisfactory job is being done with brattice and therefore auxiliary blowers have not been considered. It is possible to get 6,000 cfm at the machine 70 ft from the crosscut, with a velocity of 600 fpm, or enough to push the air ahead. This, plus the effect of the motor blower and the operation of the miner arms, results in a satisfactory situation at the face.

With the intake on the wide side, much more air is required for the necessary velocity—up to 35,000 to 40,000 for 600 fpm under conditions in this particular mine.

With narrow-side intaking, the operator on that side has little trouble with dust but men behind him get it, though not as badly as the operator on the wrong side. Also, the men behind get some benefit from leakage through the canvas. Aside from dust, putting the operator in a better position at certain stages in pillaring is another reason for dual controls.

At the mine in question, working sections are in areas where heading development was completed some years ago. A much-tougher situation is expected in virgin areas, and thus auxiliary ventilation is a matter of much interest.

Good spraying is effective, even without a wetting agent, but even with such spraying the position of the operator is a matter of concern with dust.

Tubing and Blower Service, Mr. Kebblish.

Mining at Loveridge, in northern West Virginia, though relatively near the E.C.&F.A. property and in the same seam, is in virgin coal and canvas has proved unsatisfactory with boring-type equipment. Gas emissions of 40 up to 240 cfm have been encountered in the faces. With the latter, to keep the return at 1%, air volume must be 24,000 cfm.

Initial mining was with canvas. With 80,000 cfm in the crosscut in driving mains 4,000 cfm could be achieved at the face with a velocity of 500 fpm at 100 ft and 130 fpm along the face itself. This was enough for a good job but necessitated bringing 80,000 cfm to the last crosscut, as noted. Eliminating leakage by intaking behind the line curtain resulted in aggravating the dust problem, while, with high rates of emis-

sion gas buildup would occur with 23,000 cfm at the face. The latter required a door and a plank line with multiple layers of canvas wetted and rockdusted—a very difficult thing from the production standpoint since, among other things, the door was in the shuttle-car road.

A blower delivering 2,000 cfm through 100 ft of 12 in tubing consequently was tried. It did an outstanding job because of the velocity at the face, but resulted in aggravating the dust problem. The next step was an exhauster pulling 6,200 cfm to the face with 100 ft of 18-in tubing. The relatively low velocity in the face zone tended to result in short-circuiting and gas buildup. However, it was good from the dust-control standpoint.

Blower and exhauster together was the next test. Volume was the same, ventilation was good at the face, but the dust situation was worse than with exhausting, more time and labor were required, the extra equipment posed a space problem, and an essentially dead-air condition was created behind the face, with consequent failure to move gas from the roof and ribs in the area between the blowers and the face.

The latest system involves an exhauster with 14-in tubing, plus a 10½-in centrifugal fan with hydraulic motor and 14 ft of 6-in tubing mounted on the opposite side of the miner from the exhaust line. Its purpose is to knock the gas out of the corner with its output of 650 to 700 cfm. Overall air movement is around 4,500 cfm with 100 ft of 14-in tubing, which gives good ventilation up to a methane-emission rate of around 90 cfm. Between 90 and 180 cfm, a second ex-



WEST VIRGINIA OFFICERS—G. R. Spindler, head, School of Mines, West Virginia University, secretary-treasurer; R. G. Lazzell, development and research engineer, Island Creek Coal Co., new president; George W. McCaa, general manager, Hanna Coal Co., retiring president of the West Virginia Coal Mining Institute.



CENTRAL APPALACHIAN SECTION LEADERS—Charles T. Holland, head, Dept. of Mining Engineering, Virginia Polytechnic Institute, secretary-treasurer; H. O. Zimmerman, manager of coal properties, Inland Steel Co., retiring chairman. Carel Robinson, of Robinson & Robinson, new chairman, was unable to attend the sessions.

hauster will be used, and above 180 a third exhauster. With this system, methane concentration at the face can be kept under 3½%—with rare exceptions—at emissions of up to 90 cfm.

Answering questions, Mr. Kebblish said that a system involving the impinger and an exhauster into line brattice might work: that recirculation with the systems he described is a possibility but that USBM work had shown that some recirculation was not deleterious; that stratification of methane at the boom end of the pickup loader was a problem and that with a second fan on the loader the tubing would be turned up to work on this stratified gas; and that a Microdyne unit was being installed on the miner to see if a solution to the dust problem could be evolved. The hope is that with the unit on the front of the machine good air agitation can be secured all across the face, while at the same time the dust would be collected and discharged to the conveyor. Tubing would still be employed in the place.

"A Joy Microdyne Air Cleaner Mounted on the Twin-Bore Miner," D. Wiebe, Joy Mfg. Co., Franklin, Pa.

"Our most-recent development is an extremely compact 6,000-cfm fan-air cleaner unit which is currently being mounted on our Twin-Bore miner, and which can probably also be mounted on our ripper-type machines . . . Several unique features of the machine-mounted unit are of considerable interest.

"A fixed air-intake position can now be established at a point which maintains its relative position and distance

from the place where the material is being broken, in contrast to the intake being continually left behind while the machine is advancing . . . The fixed intake point . . . can be appropriately located to the point of most-intense dust liberation. The same holds for the most-effective dilution of gas in corners, kerfs or other areas protected by face machinery from diffusing air currents . . ."

The complete unit is 19 in in diameter and 53 3/4 in long, with a capacity of up to 7,000 cfm. A larger 8,000-cfm unit is being studied, with a 20-in diameter and the same length.

"Method of Ventilating Development and Retreat Section Using Ripper-Type Miner in Northern West Virginia," William Poundstone, superintendent, Humphrey No. 7 mine, Christopher Coal Co., Osage, W. Va.

"Ventilation is probably our most critical problem at Humphrey mine. It has, to a large degree, dictated our whole mining system, and even the type of equipment we use. We were fortunate in having operating experience in adjacent mines for a good appreciation of the problem before the mine was open . . .

"The methane in this area seems to be concentrated largely in fissures and cracks, and in the numerous slips and clay veins found in the seam . . . a heading driven into the solid coal intersects these small fissures or cracks and gas is released. This gas will continue to flow for some time from the ribs if another place is not driven between the existing one and the solid coal.

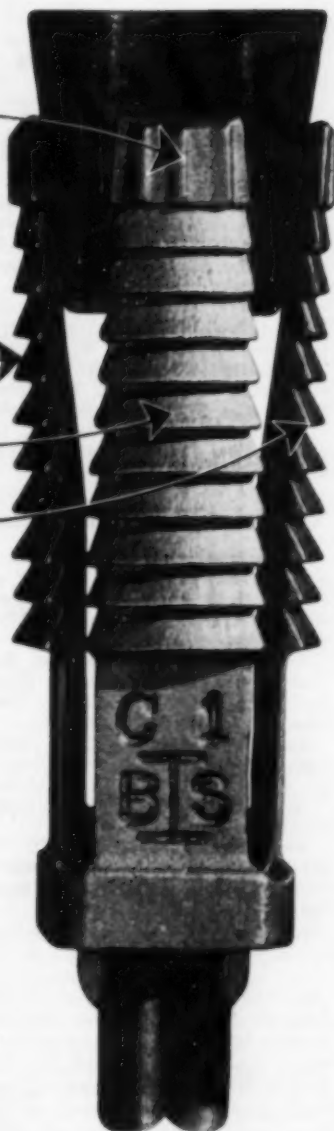
"Almost all the gas liberated, in other than the face area, flows from the coal

into the two outside headings in our development sections. For this reason we do not place track or wire in an outside heading because of the possibility of a gas feeder nearby. In fact, we use split ventilation in all our development work so that both outside ribs bleed directly into the return. This is accomplished by overcasts. By split ventilation I mean that air is coursed up the center headings of a section and back the outside places by using two rows of stoppings. With this system we rarely ever detect as much as a few hundredths of a percent of gas in the intake, even in gassy work . . .

"On a larger scale this same principle is applied in our recovery work. Before pillaring we develop around a block of coal that measures at least 2,000x2,000 ft. In effect we cut off all gas flow into the block from outside areas. With this done we rarely have a gas problem in mining a block—at least until we start to pillar and get gas from other strata."

Air control is accomplished with check curtains and line brattice. By working from the side to the center of sections with either one or two machines it is never necessary for a shuttle car to pass through a line curtain or check. In working places, the intake is on the wide side. The canvas is placed against roof bolts sprung into place. This is possible because the bolts are slightly longer than seam thickness. Extending the line curtain is the roof-bolter's responsibility and he does it because it makes conditions better for him. When the miner moves to advance the next place the line curtain is moved to the center of the place to provide more area for air travel and

Here's where
it takes
hold



This is the expansion shell used on the end of a Bethlehem Headed Roof Bolt. Inserted in a hole drilled into the mine roof, the serrated leaves of the shell expand quickly when the tightening of the bolt draws the plug down on the threads. In a matter of seconds, the shell and bolt are locked in the hole, thus providing a firm, secure roof.

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The Bethlehem Headed Roof Bolt, used with the malleable-iron shell, is furnished in three diameters, each of which is made in varying lengths. The $\frac{3}{4}$ -in. carbon bolt and the $\frac{5}{8}$ -in. high-strength bolt have a typical breaking load of 24,000 lb; and the $\frac{3}{4}$ -in. high-strength bolt has a typical breaking load of 45,000 lb.

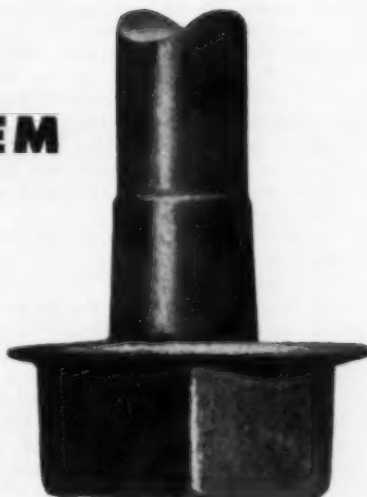
We also manufacture a 1-in. slotted roof bolt, which is used with a steel wedge. Either bolt, headed or slotted, can be used with square plate washers, angle washers, or roof ties.

Why not include roof bolting as part of your safety program? If you will contact the nearest Bethlehem sales office, we'll arrange to have an experienced engineer discuss bolting techniques at your properties, and render assistance to bolting crews.

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to prevent interruption if a prop should be dislodged.

With this system it is possible to put all the air to the mouth of the place. Ripper-type machines were selected because they permitted adopting the system used. Canvas can be maintained much closer to the face and high velocity therefore is not necessary. With a small-area front end the terrific gas buildups at the face and in the corners are prevented. And hanging canvas on the return reduces chances of trouble in moving back, etc.

Float-dust is an element in return-side ventilation but the problem of rendering it inert is not greatly increased, while visibility and comfort are definitely improved. Also, if the air current is interrupted, dust buildup signals that fact immediately.

Split ventilation involves more stoppings and overcasts, but the results are better ventilation and higher crew efficiency. The system at Humphrey is of course one of many possible and not the last word. "However, I do feel the ultimate answer must be not only an effective ventilating means, but also a system with the fewest possible chances of human failure. To date the most practical way we know of trying to prevent ventilation interruptions and human failures is to avoid moving men and machinery through checks and line brattice."

After completing his formal presentation Mr Poundstone summarized his predrilling program which consists of drilling an angling hole out from one corner of the outby headings. The longest so far is 80 ft and the inby end is about 15 ft out from the rib line. Equipment for boring up to 1,000 ft is being studied. Boring outside of the heading eliminates fighting gas as the miner works up the hole. The holes have been very helpful, and in effect are another outside heading for bleeding off the gas.

The gas problem is not entirely at the face, Mr. Poundstone also noted. Inflow from the ribs results in buildup behind, and consequently he feels moving the air forward over the machine to the face is basically best in the working place. Only a small fraction of the total gas is from the face alone. The majority comes from ribs and from bleeders from pillar sections. Rate of coal output can be varied to alter the liberation rate and thus keep gas percentage in the return at not over 1%.

"The Use of Large-Diameter Boreholes for Return and Bleeder Air Shafts," D. C. Ridenour, chief engineer, Olga Coal Co., Coalwood, W. Va.

One advantage of the pressure system of ventilation is that "the accumulation of methane in gob areas can be effectively prevented by the addition of boreholes to the ventilating system. The

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Secretary-Treasurer—Charles T. Holland, head, Dept. of Mining Engineering, Virginia Polytechnic Institute, Blacksburg, Va.

combination of the pressure system with large-diameter boreholes has been very effective in the ventilation of two gaseous mines—the Olga No. 1 and No. 2, in McDowell County, West Virginia," especially where "faults" or wants result in long irregular-shaped fingers of coal.

East Main "D" in Olga No. 1 is one such section 1½ mi long and as narrow as 1,500 ft in one place. A 36-in unlined hole 733 ft deep was drilled. "By adding the borehole air can be forced through gobs or along pillar lines to bleeders to prevent accumulation of methane in the gobs. The fact that the air moves past the pillar line into the gob is assurance of good ventilation in pillar workings."

A 48-in hole 975 deep with 4-ft 64,000-cfm fan helps ventilate 3 W in Olga No. 2 mine. Discharge is 40,000 cfm with the fan stopped. With the fan running, methane content of the discharge is 1%, compared to 0.9% at the E.M."D." hole.

In the discussion and question period, Mr. Mauck noted that with the Olga system gas is not being impounded or carried long distances. In some known-to-be-gassy mines it is possible to venti-

late entirely through large boreholes. Four to five 60-in holes now can be drilled for the price of one shaft, and the holes can be distributed better for most-effective ventilation with fewer air-courses.

Two of six holes at Olga have been lost, but the three main ones are still intact. Cost of the 36-in hole, including pregrouting, road building, etc., was \$107 per foot; of the 48-in hole (much more road building over mountain terrain), \$125 per foot. Holes can be used as escapeways.

"Ventilation Control Practice in a Gaseous Mine," L. D. Ellison, chief mining engineer, Island Creek Coal Co., Holden, W. Va.

Changing from hand to mechanical and continuous mining results, among other things, in sharply reducing the number of working places but increasing methane liberation and the difficulty of getting air to the face.

Two shafts served the very gaseous Bartley No. 1 mine when it was opened in 1924. Additional ones have since been sunk, including several to permit operating long fingers. The mine produces around 12 million cfm of methane a day and is ventilated by three 8-ft exhaust fans on 18-ft shafts producing approximately 1,500,000 cfm at 6.2, 5.0 and 4.0 in.

In development, air is split from the center to both sides, and should methane percentage in the immediate face area rise to 1% work is immediately stopped. The average is 0.5 to 0.6%. In a miner development area, around 20,000 cfm is passed directly over the machine except in one heading.

In active pillaring sections, wood stoppings, doors and check curtains direct air across the pillar line, with regulators to the back side of the line and to right and left bleeders.

Bleeding Practice, Mr. Krickovic.

Bleeding is one of the most-misunderstood of the ventilation operations, and too frequently openings are included without too-much regard for what might happen to make them ineffective. The big problem is along property lines. A pressure differential is necessary. Therefore a heading alongside is necessary as a return and access way. Any bleeder opening, in fact, should be accessible from a tracked intake.

Bleeding is essential with continuous mining in the Pittsburgh seam. It must be accompanied by proper regulation and also adequate face ventilation.

In amplification, Mr. Suter noted that bleeders by their nature can be expected to be effective for only a time. The biggest mistake is to assume that they are a cureall.

At Bartley No. 1, Mr. Linkous ob-

served, 6 to 8 rows of blocks are left to protect openings to the shafts and hold them open until the fingers are mined. The present bleeders use 16 to 17% of the mineable coal. But they are effective, since it is often a year at a time before gas is detected in the pillar area.

"Energy for Tomorrow," Ivan A. Given, Editor, *Coal Age*.

Based on expected population increases of up to 25 million or more in the next 7 to 10 yr, energy use in the U. S. should increase by 12 to 15 quadrillion Btus a year by 1965, equivalent to 480 to 600 million tons of coal. For that reason, *Coal Age* and its affiliate, *Key-stone Coal Buyers Manual*, expects a domestic bituminous consumption of 610 to 710 million tons in 1965, with exports bringing the total up to 710 to 830 million, compared to 487 million in 1957.

Nuclear energy will be a negligible factor and technological developments that might cut coal consumption materially are not likely before 1965 or 1970—if then.

"Oil and natural gas will remain coal's principal competitors. But their competitive power will not be any greater than in the past, except when dumping is consciously practiced, while time is working in coal's favor, particularly price-wise.

"Since neither oil nor gas, nor both together, can take all the new energy market, and since, in fact, coal is likely to increase its share, the next 5 to 10 yr should be good ones for coal."

"Electronic Controls and Communication," Earl Berry, Mine Safety Appliances Co.

"Electronics will be usable in every business and all industries, and I believe especially so in the mining industry. Mining is basically a materials-handling operation employing a very wide and diversified range of highly specialized equipment scattered over a relatively large area in contrast to a compact manufacturing plant. Therefore, the application of electronics would encompass two fields of activity insofar as mining is concerned."

One field would cover local or immediate control, indication, etc., in the immediate vicinity of the particular machine or activity, such as, level control and indication—both solids and liquids; pressure and temperature control and indication; explosive gas, toxic gas and fire detection and indication; direction of movement or travel, switching in all its forms, starting, stopping, speed up, slow down and alternate action or selection.

The second field involves remote control, indication, detection, etc., from some central point, using pushbuttons and pilot lights, telemetry (information reporting), television and oral communication. All four can be done over a single carrier or line.

"Automation of Mining Machines," Gerald von Stroh, Mining Development Committee, Bituminous Coal Research.

By the end of this century, tons per man-day could reach 160. Though this might seem fantastic, it would really be more surprising if coal did not reach this figure.

As the tools of automation become available, machines and methods will change to accommodate them. To date much of the increase in productivity has been attained by cutting crew size. The alternative for the future is increasing machine capability. Automation will come almost automatically, in fact, and the big need for the mining staff of the future will be for:

1. Industrial engineering.
2. Operations research.
3. Scientific selection and training of men.

Answering questions, Mr. von Stroh listed the next important advance in mining as roof support, plus face transportation that can be retracted and extended automatically, diesel engines on shuttle cars, and sensing and indexing equipment to automate a ripper-type mining units.

"Presently Available Automation Techniques Applicable to Haulage and Classification of Coal in Carload Lots," John G. Kneiling, Staff of Theodore J. Kauf-feld, consulting engineer, New York.

"Automation techniques available permit the operation of unmanned trains among any group of stations and terminals, over a track system of any required complexity. Automatic classification is based on automatic reading of car serial numbers with commercial data-processing equipment. These techniques are applicable to problems of inventory, order-selection, product blending, etc. In combination, automatic route-seeking cars and automatic classification permit direct labor saving, capital reduction, greater utilization of plant, greater safety for employees and, sometimes, better product quality."

Coming in Coal Age . .

A roundup of the present status of electric space heating, including the plans of the electric-power companies to promote its wider use and coal's stake in this development, will be a feature of the January, 1959, issue.

In February, *Coal Age* editors will present their Annual Review issue, complete with economic review, trends in mining and preparation, safety performance in 1958 and equipment sales.

Both issues will contain a full list of articles on successful deep mining, stripping and preparation enterprises, plus up-to-date features for electrical and maintenance engineers.

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TWENTY-FIVE COMPLETE SETS OF FLEXCO HD BELT FASTENERS NOW AVAILABLE IN ONE EASY-TO-HANDLE ECONOMY BULK PACKAGE

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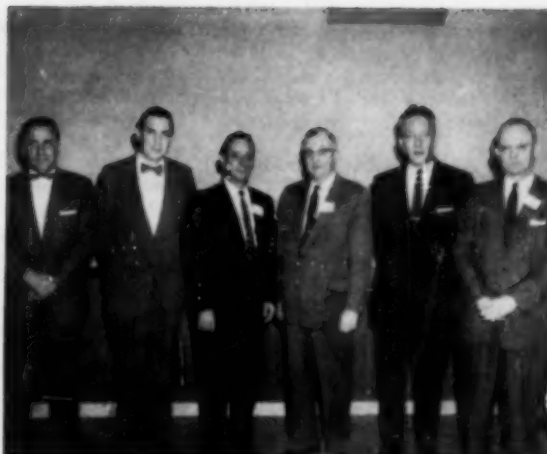
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FOR THE SPLICE OF A LIFETIME



CONTINUOUS MINING, EQUIPMENT DEVELOPMENTS, SAFETY—C. E. McWhorter (left), Goodman Mfg. Co.; John Adams, Mountaineer Coal Co.; E. Minor Pace, Inland Steel Co.; G. C. Dyar, Alabama By-Products Corp.; Kirby Smtih Jr., Kirby Koal Kars, and Lt. W. K. Juett, Dept of Public Safety.



HIGHWALL MINING, SAFETY PROGRESS, INSTITUTES—D. A. Zegeer (left), Bethlehem Mines Corp.; Dr. Richard Mateer, University of Kentucky; J. H. Phalan, Dept. of Mines & Minerals; J. B. Benson, Southern Coal Producers Association; W. T. Cahoon, Carrs Fork Coal Co.; and A. L. Kiewet.

KMI Holds 19th Annual Meeting

FACE VENTILATION and roof support in continuous mining, AC power and safety shared the spotlight at the 19th annual meeting of the Kentucky Mining Institute, Lexington, Ky., Nov. 6-7. Other topics canvassed at the two-day meeting included mining developments in Russia, development and use of truck-mine equipment, coal drying and desliming, the importance of local institutes and mine fires and explosions. Norman Yarborough, U. S. Steel Corp., Lynch, Ky., KMI president, was in charge of the meeting. In the business

session closing the meeting, members elected officers as follows:

President—B. F. Reed, president, Turner Elkhorn Mining Co., Drift, Ky.

First Vice President—H. B. Jones, general manager, Eastern Coal Corp., Stone, Ky.

Second Vice President—Edwin McGaw, general superintendent, West Kentucky Coal Co., Madisonville, Ky.

Third Vice President—Noah Mayhew, superintendent, Blue Diamond Coal Co., Leatherwood, Ky.

Secretary-Treasurer—James H. Phalan,

chief, Kentucky Dept. of Mines & Minerals, Lexington, Ky.

Directors—William Crawford, Princess Elkhorn Coal Co.; H. O. Zimmerman, Inland Steel Co.; R. W. Jones, Kentland Elkhorn Coal Co.; R. V. Venable, Feds Creek Coal Co.; W. T. Cahoon, Carrs Fork Coal Co.; B. W. Whitfield III, Harlan Collieries Co.; E. B. Taylor, High Splint Coal Co.; S. A. Fox, Blue Diamond Coal Co.; Norman Yarborough, U. S. Steel Corp.; Harold Kirkpatrick, Beach Creek Coal Co.; and Herman A. Knight, West Kentucky Coal Co.

Abstracts of papers are as follows:

Recent Mining Developments in Russia, C. E. McWhorter, Goodman Mfg. Co.

In March 1956 the Soviet Ministry of Coal Industry suggested an interchange of technical visits between Great Britain and themselves. Accordingly, with mutual agreement, the British National Coal Board sent a party of coal experts to the Russian coal fields.

Coal beds are fairly shallow, the deepest being 1,200 ft. They generally are level and free of faults, but a few pitching seams up to 35 deg are mined.

While the Russians have made great strides in developing machines for coal mining, they are all practically for longwall mining. A great deal of time and money are being spent in an attempt to mechanize roof control along long faces. Many ideas have been tried and some of them show promise.



PREPARATION, POWER, SAFETY—J. H. Phalan (left), Dept. of Mines & Minerals; R. S. James, USBM; Aubin Higgins, West Kentucky Coal Co.; W. J. Simonton; A. C. Lordi, Westinghouse Electric Corp.; and Robert Grimm, Inland Steel Co.

Auxiliary Fans to Improve Face Ventilation in Continuous Mining, George R. Higinbotham, president Mountaineer Coal Co., Fairmont, W. Va. (read by John Adams, production engineer).

The industry is now confronted with an acute face ventilation problem. The use of line brattice is not dependable and does not always maintain a gas-free atmosphere. Continuous miners, especially the borer-type, virtually fill the working area and act as a barrier to the flow of air to and across the face.

With penetrations of 200 ft or more per shift, these miners will expose a new face every minute. Where gassy conditions exist, mining often must be stopped and the machine withdrawn so gas can be cleared. These interruptions seriously affect production, but are secondary to the constant threat of gas ignitions caused by cutting bits striking pyritic inclusions.

Conclusions from tests with various ventilation systems indicate that line brattice cannot be expected to provide the safest atmosphere in continuous miner places. Auxiliary fans are now being considered by regulatory agencies. They point the way to a method of providing substantially improved face ventilation.

Roof Support With Continuous Mining Equipment, G. C. Dyar, general superintendent, Alabama By-Products Corp.

Three continuous miners and five conventional units produce 10,000 tpd in three shifts at Maxine mine. Immediate roof is black shale varying from 4 to 10 in thick. Over this is gray shale and shale with sandstone streaks, and above these strata is massive sandstone. Vertical slips, hidden by the black shale, occur from 3 to 30 in apart.

Roof is supported by 30x-in expansion-shell-type roof bolts in normal conditions. Spacing is on 4-ft centers in entries and 6-ft centers in rooms. In weak roof, 48-in bolts and a wood header are installed. Approximately 80% of all bolts are recovered but no effort is made to recover expansion shells.

In continuous-miner sections crossbars on mine jacks are used on 4-ft centers. Jacks are set in offsets in the rib to enable the pickup loader to make a good cleanup. Shuttle cars also are able to travel in unobstructed roadways.

In room panels, the first pair of rooms is driven 270 ft with blind crosscuts cut to the left. Succeeding rooms tap the crosscuts, through which roof-support supplies are brought. Rooms are driven 28-ft wide in conventional sections and 17½ ft wide in continuous-miner sections. Pillars are left in to support a coal seam 55 ft above.

The continuous miner operator is never out from under the supported

area and the timbermen are never 4 ft from the last collar. Large areas where the black shale could be loosened by explosives can be worked by continuous miners under temporary support. Using crossbars and jacks, the cost has been 33¢ per ton less than in conventional mining.

Highway Safety, Lt. W. K. Juett, Dept. of Public Safety.

Highway accidents are responsible for 40,000 deaths and 2 million injuries a year. To make highways safer, the following are needed.

1. A certified ownership issuance program.
2. Periodic inspection of all vehicles.
3. Driving education for young drivers.

If coal company employees are to take home with them the safety practiced at the mines they must be courteous, cautious and use common sense while using the highway.

Recent Developments of Truck Mine Equipment and Its Usage in Small Mines, Kirby Smith Jr., Kirby Coal Kars.

Nobody was much concerned with small rail or truck mines until recently. But when the cost of labor became greater and greater and the market became weaker and realization dropped we began to see medium-size mines being forced out of business with alarming rapidity.

Mechanization was possible, but the initial investment and maintenance were high. As a result they sought a different and cheaper way to mine coal. Thus we saw the birth of a new industry and the rebirth of an old one—the truck mine.

This new industry was conceived by mechanically-minded truck-mine operators who were ingenious enough to build for themselves haulage equipment out of old car parts. The next step came when men who are primarily interested in mechanics, electricity or welding realized the potential and were willing to risk the capital and the time to develop it. The pioneers in this field were the Kersey Bros., Bluefield, Va. and Vernon Osborne, Wise, Va., both of whom started about 12 yr ago.

Now let us go into the types of equipment and what you can expect from it. First there are trailing-cable cars which come in two types: end-dump and drop-bottom. Both styles are available in 1-, 1½-, 2- and 3-ton sizes. These shuttle cars are powered by 5- to 7½-hp motors. They are usually equipped with brakes, lights, reversible controllers and 250 ft of cable.

The load on end-dump cars is so balanced that it is gravity dump. There are two types of dropbottom cars: self-latching and ratchet-and-chain closing.

These cars have two speeds, 1½ and 6 mph.

Trailing-cable cars are practical up to 1,500 ft. This limitation of distance is particularly applicable to the end-dump car which runs from the face to the tippie. In the case of the drop-bottom unit there is more latitude since it can be kept inside and used exclusively on cross entries with transfer points on the main line. At one Virginia operation three 3-ton dropbottom cars are loaded by Joy 8BU loaders. The cars haul coal to the main, pull up on a ramp, dump the coal onto a conveyor which discharges into mine cars. This mine is producing nearly 400 tons per shift with 12 men. Another mine in 40-in coal has three 2-ton dropbottom cars and is mining 175 tons with 5 men. The price of these cars ranges from \$1,150 to \$2,750.

Another type of rubber-tired equipment is powered by batteries. These units range in price from \$3,980 to \$8,860. All manufacturers build rubber-tired mine cars with capacities from 1 to 3½ tons. Price ranges from \$350 to \$560.

The other principal type of rubber-tired equipment used in conjunction with this haulage equipment is rubber-tired machine trucks. These trucks are self propelled and can be used to move other equipment.

New Developments in Safety, J. B. Benson, director of safety, Southern Coal Producers Association.

A number of things have been developed in recent years to improve safety in coal mines. One of the newest items under development is the glass machine bit which will eliminate sparks during the cutting operation. About 10 yr ago the idea of an inflatable stopping was introduced. A group of these should be on hand at coal mines for emergency use in mine rescue work.

An electronic testing device for checking roof may be available in the future. In Pennsylvania "shaving cream" is being used experimentally to allay dust at the face. In Russia a monitoring device is used to detect emission of gas. The British initiated use of the foam plug for fighting mine fires. This method of fire fighting is being tested at the USBM.

Fixed lighting underground has been developed and is approved by the USBM. Some day this development will be placed on the same level as roof bolting in improving mining conditions. The USBM and various oil companies have developed a non-flammable hydraulic fluid for mining equipment. Underground tests are needed now to get operating experience with it.

Closed-circuit television is now being employed at an all-belt mine to monitor

several transfer points from a central location. The USBM is trying to develop a portable canopy for face protection. Reynold Metals is developing a lightweight roof-support system using hydraulic jacks and metal crossbars. The chemical industry is working on a viscous material which can be sprayed on the coal in place of rock dust. The prototype of the jet continuous miner is expected to go in operation before the end of the year.

Importance of Local Institutes to Mine Operators. J. H. Mosgrove, Big Sandy-Elkhorn Coal Mining Institute.

Local institutes are composed of supervisors, inspectors and manufacturers' representatives, but are principally made up of supervisors. The institute adds the third leg to the safety stool, the other two being management and labor.

An important part of the institute's work is to maintain enthusiasm for safety. To maintain enthusiasm, the institute gives safety awards to supervisors and companies. Mining classes also are partly sponsored by the local institute. About 75% of the supervisory personnel in the Big Sandy field got their start in classes sponsored by the local institute.

The local institute also can serve as a clearing house for all types of information and can keep abreast of all new developments and new regulations. It can be the public relations arm of the coal mining industry.

Importance of Local Institutes to the Safety Program of the Department of Mines. James H. Phalan, chief, Dept. of Mines & Minerals.

From the very beginning, the purpose of the local institutes has been the promotion of safety within the state through education. Invariably during this process of education the personality and character of the workmen have been developed to an astonishing degree.

All local institutes employ a full-time safety director and there is perfect co-ordination in the work done by our institutes with that of the state department of mines. Safety directors always are available for safety meetings conducted at the mines, either foremen meetings or general safety meetings. Member companies report to the institute all lost-time accidents and statistical reports are compiled showing the standing of each company. Rivalry in safety is keen and the good records of some of the members are an incentive to those whose records have not been as good.

The safety and production report carried from year to year in the annual report of the department could not and

would not have progressed at such a marked rate had it not been for the efforts of the miners, operators and various safety groups, especially our local institutes.

Continuous Mining from Strip Highwalls. A. D. Henry, general superintendent, strip mines, The Powhatan Mining Co. (read by Elkins Payne, U. S. Steel Corp.).

In spite of the mammoth shovels in use, most companies eventually reach a height where it is not economically possible to strip higher and, as a result, tracts of coal under high cover remain unmined. This waste and loss of coal reserves prompted officials of The Powhatan Mining Co. to conduct experiments with continuous mining equipment under highwalls that had been stripped to about 80 ft of cover at their Betsey mine, Jefferson County, Ohio. This mine operates in the Pittsburgh or No. 8 coal which averages 56 in.

A brief review of our experience reveals many changes in the use of equipment, radical changes in design of certain components of the unit and alteration of the mining plan. During the first year of operation there were prolonged periods when the success of the venture was in doubt. During 1957 many improvements were made. Crews were better organized and only the best men were retained.

Local management designed and built the present elevating conveyor which contains a large power-driven belt reel. Use of the belt reel permits parting of the belt at the tailpiece of the extensible belt when a room is completed and winding it all up in a few minutes instead of taking it off 100 ft at a time at the belt head. This item alone has increased shift production by at least 75 tons.

Use of a small, highly portable roof-bolting machine and good men to operate it is another important item. Having standby equipment has increased our efficiency greatly.

All of these changes have resulted in a low-cost operation. At present we are producing an average of 360 tons per 8-hr shift, with a face labor cost of 70¢ per ton, 31 tons per manshift and a bit cost of 5.5¢ per ton.

The University and the Mining Industry. Dr. Richard Mateer, head, Dept. of Mining and Metallurgical Engineering, University of Kentucky.

The responsibilities of the university are threefold:

1. To train young engineers. Equipment and methods used today will be out of date in the near future, therefore education in the basic subjects is stressed.

2. Exchange of information to help solve special problems.

3. Carry on research.

Two examples of exchange of information are a training program in chemical analysis and lineal programming for solving coal blending problems. The university is not giving up hope of finding rare minerals in coal beds and also is seeking ways to improve the efficiency of coal-fired plants.

Fluo-Solids Drying and Desliming. R. M. Grimm, preparation engineer, Inland Steel Co.

Desliming, as interpreted in this paper, is the intentional removal from coal of all particles smaller than 100-200 mesh. There are numerous methods of desliming. The most common is by classification in water, another is the use of air instead of water.

The removal of the minus 100-200 mesh material may be accomplished on either the raw or clean coal and should result in the following advantages:

1. Decreased solids load in circulating water.

2. Reduced load on dust collection facilities.

3. Possible reduced maintenance on pumps and pipes.

4. Decreased ash in clean coal.

5. Decreased moisture in mechanically dried clean coal.

There are some disadvantages to consider:

1. Loss in recovery of clean coal. Desliming unless followed by some coal reclamation facilities would result in loss of whatever carbon values are found in an unslimed coal.

2. Increased capital investment required not only to deslime but also for subsequent treatment, handling and disposal of slimes.

If your $\frac{3}{4}$ x0 raw coal is of such a nature that the loss of the coal values due to desliming can be offset by the increased recovery made possible by the lower ash of a deslimed coal, you and intentional desliming are in business. The problem of whether or not to deslime is one worthy of careful study. Each plant is a case in itself and no general rule may be applied.

Among the many benefits of heat drying for Inland Steel Co. are:

1. Decreased unloading problem because of frozen cars of coal.

2. Increased bulk density in coke oven charges.

3. Less oil required for bulk density control.

4. Decreased transportation costs.

Our drier is only the third such unit placed in operation. The plant was designed and constructed on a turnkey basis by the Dorr-Oliver Co. It is housed in a building about 90x35x60 ft. Wet coal is brought into the plant

by a 30-in belt conveyor which discharges coal into a 50-ton surge bin. The wet coal is conveyed into the drying vessel by twin Jeffrey screw feeders.

The reactor is a vertical cylinder about 14 ft in diameter and 20 ft high. The wet coal feed falls toward a construction plate located horizontally about 12 ft from the bottom of the reactor. The plate is made of a series of T-shaped stainless steel bars about $\frac{1}{8}$ in apart to form a slot for hot air distribution. Coarser particles of the wet feed are put into teeter (or fluo-solid condition) by the high velocity hot air. These particles are crowded and bounced from the feed point to a discharge gate. This method of conveying is unusual in that there are no mechanical parts in the hot air to convey the coal.

The discharge gate is air operated and located opposite the feed point at constriction-plate level. The coarser dried material falls into a sealed surge bin. The finer particles (roughly minus 28M) are blown up through the reactor into a common duct, which delivers the finer fraction to the top of six air cyclones. The reactors, ducts and cyclones are lined with either brick or gunite for insulation and abrasion resistance. The fines are thrown to the outside of the cyclone and discharged at the bottom. These fines are dropped into the surge bin or into sealed scraper conveyors.

The dusty air containing ultra fines is spiralled upward from the bottom of the cyclones and discharges at the top. This dusty air travels under pressure toward a Peabody gas scrubber. In the scrubber all exit gases pass through a pool of water, which is expanded by air, and thence to three stationary water eliminators.

The fan, driven by a 1,000-hp motor, supplies all of the air needed to dry and convey the coal. We have a Babcock & Wilcox pulverizer which processes either reactor underflow or cyclone underflow for use as fuel.

The drier was designed to evaporate 25 tph of water. All conveying equipment was designed to handle 230 tph of wet $\frac{1}{2}$ feed. At this time the drier is drying 175 tph of $\frac{1}{2}$ coal from 14½% total moisture to 4-4½%. The feed is $\frac{1}{2}$ clean coal which has been dewatered by Bird centrifugal filters plus 15 tph of clean $\frac{1}{2}$. We are evaporating about 18 tph of water. To do this we burn about 2½ tph of pulverized coal and use 88,000 cfm of air.

In conclusion I can say that the Inland Steel Co. has experienced normal start-up difficulties. The Dorr-Oliver Co. is continuing to cooperate with us to find more satisfactory answers to some of the problems with attendant or accessory equipment. We must say that the Dorrco drier has demonstrated that it can do an efficient and closely

controlled job of coal drying with what appears to be a low maintenance cost up to now.

Application of Continuous Methane Alarms with Power Shutoffs to Gassy Coal Mines. R. S. James, chief, Branch of Electrical-Mechanical Testing, U. S. Bureau of Mines.

Development of a continuously monitoring methane system involves many problems, such as: Its effect on production; who will decide where it is needed; how many will be needed per mine; and who will service them. The truth is that solutions to these problems have not yet been found.

The various manufacturers that have entered this program have indicated that these systems can be made practicable and also with reasonable economy. Such programs require time and patience, but even now some companies are ready to submit prototypes to the Bureau for their test.

Use of this device will provide far greater protection against accumulation of explosive mixtures in face areas than has ever before been achieved. The methane monitor will sample the atmosphere continuously, eliminating dependence on the human element. One last advantage of the methane monitor is the added degree of safety provided by the signaling device. If this device functions by superimposing an alternating-current voltage back over the trailing cable to a circuit breaker, a signal from the detector indicating that 2½% methane is present will open the breaker circuit. Simultaneously this could be used as protection from a ground fault.

Advantages of AC Equipment Underground. J. A. Dunn, chief electrical engineer, Island Creek Coal Co.

AC powering is more efficient than DC. Transforming high voltage to utilization voltage is approximately 98% efficient whereas converting to DC is approximately 91.5% efficient where the ignitron rectifier is used. On a 300-kw demand load at 40% load factor, the annual cost in the difference in efficiencies would be approximately \$1,100, using a power cost of 1½¢ per kwh.

When considering the cost of transforming to utilization voltage versus conversion with the ignitron rectifier, the first cost is very much in favor of AC. Electrical maintenance is one place where AC has a distinct advantage over DC. In most cases where it has been possible to compare maintenance under similar conditions, the maintenance ratio has been 10 to 1 in favor of AC-powered mining machinery.

Large amounts of AC power can be economically distributed throughout a mine with very little loss by the use of

high voltage. This would be true also in case underground conversion stations are used. But with AC stray currents and voltages will not be present as with DC-powered machinery.

Safety Features of AC Power in Underground Mining Operations. A. C. Lordi, Westinghouse Electric Corp.

The greatest advantage of the AC mine over the DC mine is the increased safety from shock and ignition hazards. Safety grounding, extremely low ground-fault currents, non-sparking rotating machines and fast, sensitive protective relaying are easily realized with three-phase AC power, whereas they are difficult to obtain in DC systems. The small additional expense for the safety features available is easily justified by the increased safety to mine workers and supervisors.

A mine receiving power at a voltage above 15 KV requires a surface substation to transform the incoming line voltage down to a distribution voltage that may be carried safely underground. Distribution voltages range between 2.4 and 13.8 KV.

At the mine bottom a distribution center is desirable to provide individual protection to branch circuits, which may be for AC and DC power circuits. An AC power center transforms power from the distribution voltage to the utilization voltage, usually 480, to feed the face equipment either directly or through remotely located low-voltage distribution centers.

Low impedance grounds are difficult to establish and maintain underground. For this reason, the ground established at the surface transformer secondary neutral resistor ground point is carried underground to attach to the frames of the switchhouse, rectifier, power centers, low voltage distribution centers and finally the face machines. These ground wires serve to minimize the potential to ground of the equipment frames, and usually are included within the mine power feeder cable.

No intentional metallic connection is made between the AC ground wires and the DC track. This isolation minimizes the flow of DC stray current through the cable ground wires when track bonds are broken or loose. DC stray currents through the cable ground wires can reach sufficient magnitudes to overheat the AC cables.

Mine Fires and Explosions in Kentucky. James H. Phalan, chief, department of Mines and Minerals.

Since our last meeting there have been reported 16 fires, four on the surface and 12 underground. Three of the underground fires were in abandoned mines. The loss of two lives resulted from two of these fires.

Chevrolet's new El Camino combines fresh beauty with a husky pickup box that's 76 $\frac{1}{4}$ " long, 64 $\frac{1}{4}$ " wide.



THE BEST YET OF THE BEST SELLERS...

CHEVROLET TASK-FORCE 59 TRUCKS



Short-stroke V8 economy combines with heavy-duty chassis for top hauling ability at low cost in this 1959 Series 80 Chevy Tandem model.

For '59, the brightest new ideas in trucks are Chevrolet's! There's the new El Camino to set a new standard in styling... new features and refinements in every model to set new records for saving!

Here is the soundest, savingest, sharpest looking line of haulers that ever hustled a load! For evidence, consider the dazzling new El Camino. It combines slimlined beauty with the ability to handle man-size hauling jobs!

Or take the pickups of Task-Force 59—a dozen big-bodied beauties that suit scores of jobs with five handsome Fleetside models and seven handy Stepside models!

A new edition of the famous Thriftmaster 6, standard in light-duty models, gives up to 10% greater fuel economy—up to 20% with new maximum economy option*. And in the medium- and heavy-duty classes, you'll find new V8 power... axles, transmissions, frames and brakes that are refined and improved to whip the toughest runs.

Whether your truck is a light-, medium-, or heavy-duty job, these are trucks you've got to see! They're on display right now at your Chevy dealer's... Chevrolet Division of General Motors, Detroit 2, Michigan.

**Optional at extra cost.*

NEW MIGHT, NEW MODELS, NEW MONEY-SAVING POWER!



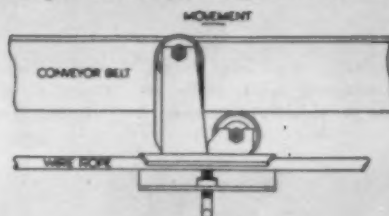
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The **LONG** *Lo-Rope* BELT CONVEYOR



- **Automatic Self-Training** is provided since idlers rock in direction of belt travel.
- **Greater Safety** results as there are no side obstructions at level of carrying belt. Handling men and supplies is safe and easy.
- **Adjustable Height** rope supports minimize blocking—permit belt leveling in undulating bottom. Height adjustments for all seam thicknesses.
- **Greater head room** for handling men in thin seams. Carrying surface of belt may be as low as 9" from bottom.
- **Deep Trough design** reduces spillage and permits wider spacing between idlers.
- **Simpler, easier installation.** New type anchors have built-in tensioning device with quick acting rope clamps that permit use of continuous rope.
- **Overlapping rolls** eliminate possibility of belt edge contact with inside end of troughing rolls.

Lo-Rope Idler Assembly (Patent Applied For)



SELF-TRAINING... BOTH DIRECTIONS

The Lo-Rope troughing rolls and carrying belt are entirely above the rope side frame—any tipping movement of the troughing rolls is in the direction of belt travel. This gives a well-established, self-training effect *automatically* in both directions of travel.

This feature—the rocking movement on the rope as opposed to swinging—is an entirely new principle that offers important advantages not previously available.

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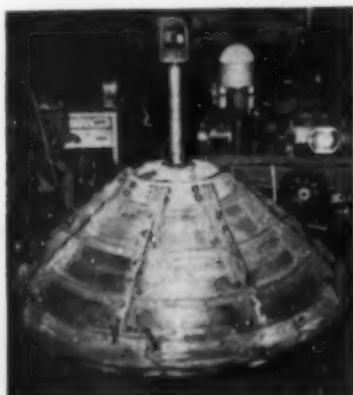
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The industry's foremost specialists in conveyor mining machinery.

Operating Ideas



Hard-Surfacing Cuts Drier Maintenance

LONGER SERVICE LIFE between reclamations, less downtime and reduced interim maintenance requirements are among benefits obtained by an eastern coal mine when components of a basket-type centrifugal coal drier are hard-surfaced. Critical surfaces are overlaid with Colmonoy No. 6 rod and Special No. 1 electrode to provide hard surfacing protection.

Relatively rapid wear is common in rotary-basket driers. The abrasive, scouring action of the coal as it moves at high speeds across exposed surfaces of the drier components wears away the surfaces. Hard surfacing substantially reduces the rate at which wear occurs.

Inherent in the hard-surfacing alloys selected is an unusually low coefficient of friction, which is retained as wear occurs. This characteristic produces an additional benefit of reduced power requirements in the drier application. Less friction between rubbing surfaces results in a lower demand on the motor.

Hard Surfacing Procedure

Following disassembly of the basket, all permanent surfaces to be hard-surfaced are hand ground to clean, solid metal to provide a proper base for the overlay. Expendable components are fabricated of mild steel.

Replacement wear pads are hard sur-

faced, prior to installation, with a $\frac{1}{4}$ -in overlay of Colmonoy No. 6 rod applied by oxy-acetylene welding. The hard surfaced pads are then welded in place on the rib support.

Electric arc welding is used to hard surface drier components having thick sections, where oxy-acetylene application is not practical. The drier's upper rib support ring is overlaid with a $\frac{3}{16}$ -in deposit of Colmonoy Special No. 1 applied by electric arc. Replacement bars for the distributor plate assembly are made of mild steel hard-surfaced with a Colmonoy Special No. 1 overlay. The distributor plate also is protected with this material.

Alloy Specifications

Colmonoy No. 6 is a nickel-base hard-surfacing alloy containing chromium borides as well as chromium carbides. It possesses excellent abrasion, corrosion and galling resistance, excellent red hardness and weldability and good impact resistance. It deposits easily with surface hardness of 56 to 61 on the Rockwell C scale.

Colmonoy Special No. 1 is an iron-base hard-surfacing alloy which also contains chromium borides and chromium carbides. Abrasion resistance is excellent and it is one of the easiest alloys to apply by arc welding. It has very good impact resistance, good corrosion resistance and good red hardness. It provides an unusually hard surface, depositing at 60 to 65 on the Rockwell C scale.



Double-Hook Cable Hangers

HERE'S a handy double-hooked cable hanger being used to support trailing cables at intersection at mines of the Boone County Coal Corp., Sharples, W. Va. The hangers are made in the company's machine shop from $\frac{3}{8}$ -in metal rods. Rods are cut 10 in long and bent on each end to form 2-in hooks. A straight 6-in rod is threaded on one end and is then welded to the center of the bent section. Shallow holes are drilled into the mine roof wherever it is necessary to hang cables. Regular trolley wire anchors are placed on the hangers which are then inserted in the holes and tightened. Hangers are recovered as mining advances.



USCOFLOW PLASTIC PIPE



New black UscoFlow Utility plastic pipe and fittings provide economical corrosion resistance—inside and out

A blend of styrene-base resins and synthetic rubber to give good impact resistance and high, effective tensile strength...

A simple installation—rapidly solvent welded...

A friction-free finish that maintains high flow-rate and resists build-up of scale or other deposits...

An economical price to solve corrosion and high installation cost problems that would ordinarily chew into your profits...

All this is the *new* UscoFlow line of black plastic pipe and fittings, specially designed for economical and efficient

handling of fluids. It has already proven its long service life, free of maintenance and downtime, and is recommended for such applications as

salt-water lines
natural-gas lines

fresh-water lines*
electrical conduit

When you think of plastic, think of your "U. S." Distributor. He's your best on-the-spot source of technical aid, quick delivery and quality plastic pipe and fittings.

*Uscolite is approved by the National Sanitation Foundation for use with potable water.



Mechanical Goods Division

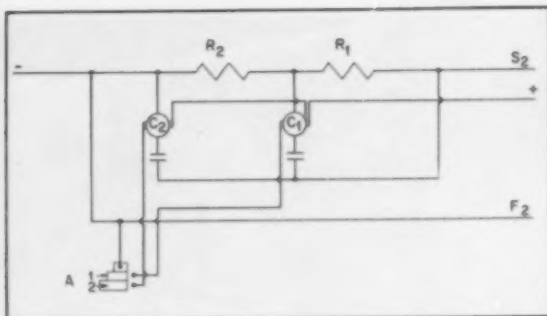
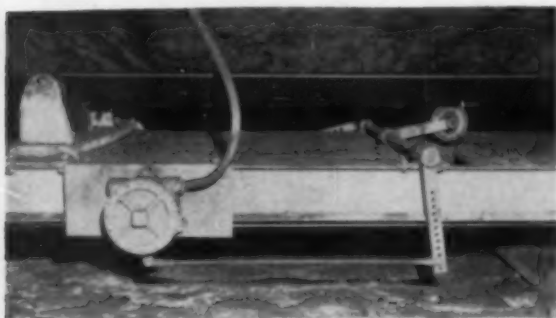
United States Rubber

WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

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Operating Ideas (Continued)



Automatic Control Prevents Belt Overloading

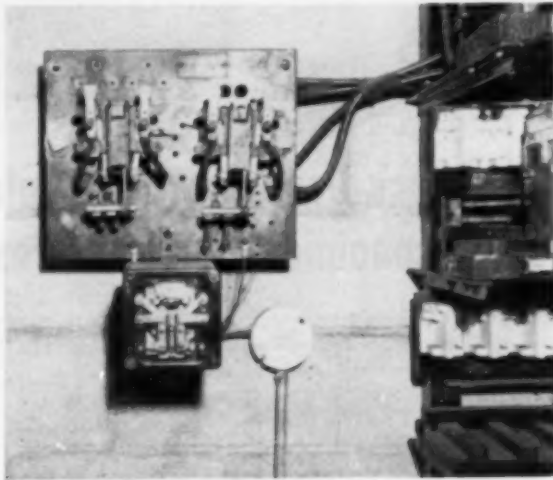
IF you have an all-belt mine with a problem of overloading the main haulage belt as a result of several intermediate belts discharging to it simultaneously at the same speed, you might try what Roy Gayhart, chief maintenance foreman, Boone County Coal Corp., Sharples, W. Va., did under similar circumstances. He designed a belt control that automatically adjusts the speed of intermediate belts to the load conditions of the main belt at the time the main belt approaches each transfer station. Thus overloading and spillage are prevented.

The control consists of solenoid-operated contactors, resistances and a shut-

tle-car accelerating switch attached to a shaft equipped with a roller (see accompanying photo). The roller is positioned in the center of and under the belt so that the load on the belt at the time it passes a transfer station depresses or releases the roller, thus controlling the speed of the belt. The control provides three speeds but never completely stops the belt.

Contactors and resistance coils are housed in a separate unit and are electrically connected to the regular belt starter by adding the auxiliary control to the series field circuit of the motor (see diagram). Operation is as follows: When the main belt is fully loaded, Contactors C_1

and C_2 are deenergized and Resistance R_1 and R_2 are added to the S_2 (series-field) circuit of the intermediate belt motor, thus slowing it down. As the load on the belt lightens, pressure on the roller is partly released which causes Switch A_1 to make contact and energize Coil C_1 , cutting out half the resistance in the circuit. Belt then increases in speed. When the main belt is empty or lightly loaded, pressure on the roller is released, breaking contact with Switch A_1 and making contact with Switch A_2 . This action releases C_1 and engages Contactor C_2 which cuts out all resistance in the motor circuit, permitting the motor to run at normal speed.



Auxiliary Control Eliminates Lamp-Charger Problems

AN ADDITIONAL CONTROL for lamp-chargers permits the units to resume charging when the AC power supply, after an interruption, is returned to normal. The auxiliary unit was designed by Roy Gayhart, chief maintenance foreman, Boone County Coal Corp., Sharples, W. Va. Before it was installed, lamps had

to be disconnected from the charger one by one until the main breaker would stay in, especially when all the lamps were on charge. When AC power was restored, the main breaker would go in but not stay because of the excessive load caused by the large number of lamps being charged.

The auxiliary control divides the 3-rack charging facility so that only one-third of the lamps are placed on charge at one time, thus limiting the initial load. This is accomplished by a Westinghouse timing relay which permits racks 1, 2 and 3 to go on charge at 15-sec intervals by contactor action.

MINING INDUSTRY USA

**NEW WHEAT NATIONAL MODEL MINER'S
CAP LAMP A SENSATION IN THE FIELD-
30% MORE LIGHT AT NO INCREASE IN
WEIGHT-A PERFECT SPOT WITHOUT
TOOLS-TWO EQUAL WORKING FILAMENTS
IN KRYPTON GAS-FILLED BULB=FAMED
WHEAT TRUE AUTOMATIC CHARGING-
MUCH MORE TO SHOW-BE SEEING YOU=**

NATIONAL MINE SERVICE COMPANY=



**WHEAT
National**
MODEL
ELECTRIC CAP LAMP

**National Mine
Service Company**



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Foremen's Forum



DISCIPLINE is best developed through training in which the reasonableness of necessary rules is clearly brought out. Safety training offers a good example of this approach.

Developing Discipline

The development of effective, acceptable discipline is a matter of training. Giving the facts, in full, on why certain activities and methods are necessary is the best way to build self-discipline.

A SUBMARINE would be a helluva place to find yourself if there was the least lack of discipline among the crew. And a coal mine is not greatly different. In either situation one unleashed smart aleck can place all members of the group in physical jeopardy. These facts are obvious. However, the big question remains: How can effective, acceptable discipline be developed?

In the hope of arriving at an answer—or at least providing food for thought—let's explore the situation as it exists and some possibilities that might be pursued. A brief appraisal of the situation

is provided in the following three points:

1. Not everyone wants to be a boss.

Most men have some urge to lead, but there are a number of ways in which this urge can be expressed. Leadership can be expressed through offices in civic enterprises, churches, fraternal orders, unions and so on. Having satisfied an urge to lead in these areas, a man may have no compulsion whatever to take on the responsibilities of job leadership. Furthermore, the step from mineworker to supervisor is getting longer, since a man must give up tangible benefits to

make the change. This is one type of man to whom the importance of discipline must be clearly defined.

2. In many instances the workman's basic loyalty will not be to the company.

He is a member of a labor organization, with interests and goals similar to those of all other members of the group. His first loyalty is to this group, and this loyalty most likely results from a lifetime of orientation and indoctrination. This is another type of man to whom the importance of discipline must be clearly defined.

3. Any system of work direction or instruction that is crammed down a man's throat is not discipline—it is a fuse to a powder keg.

Men can tolerate only so long a system which to them is onerous. The reaction will take a number of forms—surliness, grievances, lack of enthusiasm and so on. The situation under these con-

**they go up easy...
stay put!**



That simple phrase explains why more mine roof is supported with O-B Shells and Plugs than any other make of expansion unit.

Underground pull tests have proved to hundreds of bolting crews that these O-B expansion units are stronger than their roof bolts. Hundreds more have learned from personal experience that the four-way expansion of these O-B units can't be equalled for holding power in soft top.

And because bolts equipped with O-B Shells and Plugs don't have to be held in the holes before wrenching begins, bolters have both hands free to run their machines—work faster with less chance of injury to hands and fingers.

For extra strength, expansion, speed, and safety, order the Shells and Plugs that "go up easy—stay put!"

Write direct to Ohio Brass, or ask your O-B representative, for an underground test on your property.

OHIO BRASS COMPANY, MANSFIELD, OHIO
Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

Ohio Brass
(B)

4031-H



Foremen's Forum

(Continued)

ditions is about as bad as it can get.

Still the need for discipline underground exists, and before we go any further let's define the term. Webster, as one of his meanings, says discipline is the training which corrects, molds, strengthens or perfects a faculty or faculties. Now the next steps are clear: (1) pinpoint the faculty that requires correcting or perfecting and (2) get on with the training. The development of effective discipline, through application of the foregoing steps, should be taken with these three axioms firmly in mind.

1. Discipline must have a firm basis in reason.

Every business has economic reasons for the discipline within that industry. Mining, however, has the added need for discipline that contributes to personal safety of the workmen. This latter reason is the one on which mining discipline must be based, primarily. This is the most understandable of disciplines, requiring for its full realization a training effort through all possible media of communication. Safety-based discipline is most acceptable, too, because nobody wants to be the victim of a mining accident. A natural follow-up is to tell the economic message, in full and without bashfulness. Giving full, factual information to the people who need it can work wonders in building effective discipline.

2. In any American pursuit, law—not man—is the final authority.

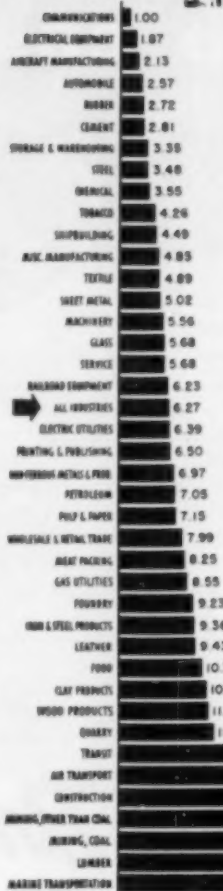
As management proceeds in its efforts to develop discipline, times of testing will arise. There will be conflict. At such times, personalities must be relegated to the background, and the question must be decided on the basis of precedent in similar cases or on the basis of ground rules and contracts between labor and management. This is the American system of legal settlement of disputes in action. Management must believe in the efficacy of this system, then it must state its beliefs.

3. Development of effective discipline requires restraint on the part of the boss—a restraint based upon assurances that he has the backing of his management.

A foreman lacking this assurance is the world's most lonesome figure. He may be forced to overlook flagrant breaches of discipline when he isn't certain in these matters. In cases where the foreman is sure of his superiors' backing, you can bet his superiors also have instructed him in his prerogatives, responsibilities and limits of authority. This is good management.

FREQUENCY RATE

DISABLING INJURIES
PER 100,000 MAN-HOURS



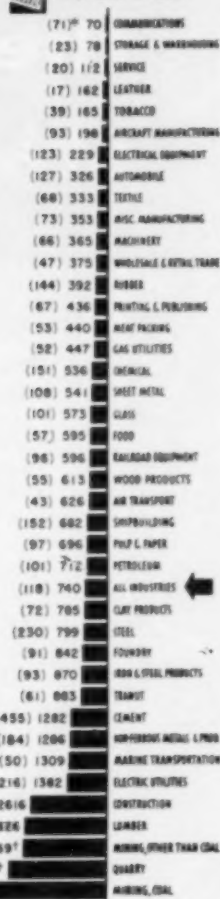
*Figures in parentheses show average days charged per case.

†1954.

All rates compiled in accordance with the American Standard Method of Recording and Measuring Work Injury Experience, Code Z16.1-1954.

SEVERITY RATE

TIME CHARGED (DAYS)
PER 100,000 MAN-HOURS



Safety in U. S. Industry

THE CHART above is the annual box score of safety performance in U. S. industries, as published by National Safety Council in its annual edition of Accident Facts. These data for 1957, when compared with similar figures for 1956 (Coal Age, September, 1957, p 96), show that coal mining has improved with respect to frequency of disabling injuries but has slipped with respect to severity. Disasters are reflected in the rise in the severity rate.

The Council says, "Progress in the occupational safety movement is apparent when the 1957 record is compared with past years. We picked from the shelves, at random, the chart for 1944 experience. It showed the 1944 average frequency rate for all industries at 14.46, while it has been forced down 13 yr later to 6.27. The average severity rate for 1944 was 1,210, but the safety effort of all industries brought the 1957 rate down to 740. And some supervisors still won-

der whether or not safety effort pays!"

Coal, too, is showing progress in spite of the flareup in late October. The final report on the year-long campaign to prevent roof-fall injuries shows that a reduction of 38% in the number of such injuries was achieved among participating companies, as compared with the previous base period. This 38% means 509 fewer injuries during the campaign. This is a real gain.

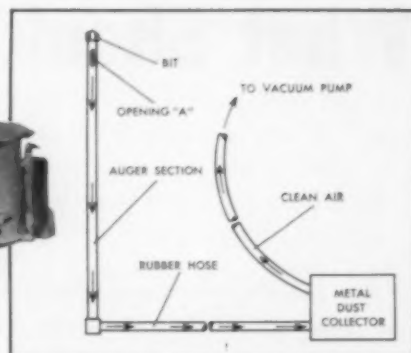
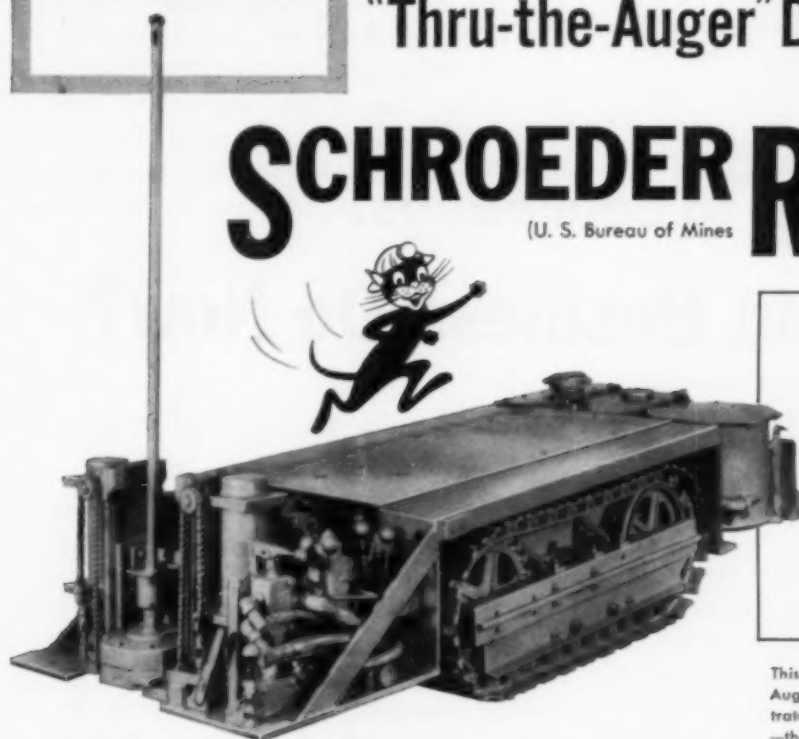
Coal mining, as an industry, can move up in the chart as it continues to stress roof safety and places new emphasis on improving ventilation in working sections. In both efforts the section foreman will be a key man. He must be the final translator of safety policy to the men. He must be the first to see the need for discipline when safety rules are short-circuited. The challenges and responsibilities of the job are quite sobering. But the returns are well worth every effort the foreman can exert.

NEW

Hydraulic Roof Bolting Machine with revolutionary "Thru-the-Auger" Dust Collection

SCHROEDER ROOFCAT

(U. S. Bureau of Mines Approved)



This sketch shows the new and unusual "Thru-the-Auger" dust collecting system. As the bit penetrates the roof the dust is sucked into openings (A)—then through the hollow auger into the heavy rubber tubing and on to the large metal dust collector mounted on rear of machine.

EFFICIENT BOLTING

QUICK DRILLING! QUICK BOLTING! Flexible, the "Roofcat" fills the need for a hydraulic machine which drills efficiently and quickly in a matter of seconds and with very little effort by the operator. Thoroughly tested, under actual mining conditions, the "Roofcat" performed well and economically.

SURE TRAMMING

COMPACT AND LOW-SLUNG, it is extremely flexible and is maneuvered positively by simple dual controls which permit crawlers to be operated in unison or independently. Adjustable to conditions, the tramming speed can be varied from an inching crawl up to 175 feet per minute.

DUST COLLECTORS

THE "ROOFCAT" CAN BE HAD with any one of three dust collecting systems. 1—Gravity type. 2—Vacuum type. Or 3—the new and unique "thru-the-auger" type which is shown in the artist's sketch above.

The machine's hydraulic system is protected by a micron filter built right into the tank.

GENERAL SPECIFICATIONS

Height 23"; Width (without riding platform) 36"; Length 102"; Feed length 22" to 38"; Roof heights 32" to 48". Optional: Hydraulic stabilizing jacks; riding platform.

Before buying just any roof bolting machine, consult a Schroeder man about the "ROOFCAT."

SCHROEDER BROTHERS CORPORATION

NICHOL AVENUE, BOX 72 McKEES ROCKS (Pittsburgh District), PA.

Hydraulic, Electric and Pneumatic Equipment

In financial aid to education . . .

What Should Business Do Now?

Now that the federal government is entering the field, should business firms stop giving financial aid to our colleges and universities?

This question is now being discussed by business directors throughout the country. The discussion is prompted by the near-billion-dollar program of federal aid to education passed by Congress a few months ago. For if the federal government, with its access to billions in taxes, is assuming responsibility for the financial welfare of education, should not business get out of the way and let the government take over? This is the general way the question is being asked.

The answer is a resounding NO.

What The Federal Program Does

The new federal program makes it possible for the government to spend the imposing total of \$900 million for aid to education over the next four years. There are still many loose ends in the program. But already it's quite clear what such funds will — and will not — do to help relieve the financial plight of our colleges and universities.

First of all, the program is not going to solve any financial problems in education overnight.

The program is just barely underway. So far no money has actually been allocated, and Congress has appropriated only \$40 million — less than 5% of the total.

More important, there is very little in the total program which will result in direct aid to colleges and universities. The program does set up fellowships to train college teachers. But most of the aid will eventually be channeled through the states to primary and secondary schools. The main focus of the program is education for national defense — strengthening science, mathematics and foreign languages in elementary and secondary schools, together with grants for counseling, testing and research.

The one big item for higher education is a \$295 million student loan program, which will help needy students pay tuition and other fees. But tuition rarely covers the full cost to the college of educating a student. So the net result could well be an additional financial strain on our institutions of higher learning.

For the three most pressing financial needs — faculty salaries, scholarship grants and new plant and equipment—colleges and universities must still rely heavily on help from the business community. And it would indeed be a major

misfortune if the recent actions of the government put a blight on this growing and substantial support to higher education.

In the last ten years, business has expanded its financial aid to education by more than four fold. In 1948, contributions were only \$24 million. In 1957, such aid reached an estimated \$125 million. Moreover, corporations have been putting a larger proportion of their total charitable gifts into education. In 1950, the percentage was only 17%. By pre-Sputnik 1956, the share had already increased to 34%, according to figures recently released by the Council for Financial Aid to Education.

Why Business Must Help

The most compelling reason for increasing business aid to higher education — at an even faster rate—is that our colleges and universities desperately need financial help. It is that simple. Private contributions to higher education must average at least \$400 million over the next ten years if our colleges are to meet rising operating costs and raise faculty salaries to decent levels. Despite the growth in business contributions, we are still well below that goal.

If our colleges cannot solve their mounting financial difficulties through voluntary help from business firms, alumni and communities — then it is to be expected that federal aid ultimately will be mobilized in a big way. In principle, if not in dollars, the 85th Congress has paved the way. Indeed, a large federal scholarship program was squeezed out of this year's legislation only in the course of last-minute compromises. And Arthur S. Flemming, Secretary of Health, Education and Welfare, has urged that the next session of Congress restore the scholarship program.

About any federal rescue operation for higher education, two things are quite clear:

- (1) Such aid will come too late to prevent irreparable harm resulting from the current shortage of funds. The need for help is urgent and immediate.

- (2) With federal taxes taking over half of all corporate income, any federal program in the end will be financed in large part by the business community.

An Opportunity

So, viewed narrowly, it is in the selfish interest of business firms to aid our colleges and universities now, rather than wait and be forced to pay later on. By doing so, they ensure that business will have a continuing supply of well-trained graduates. They take advantage of the tax laws for charitable contributions which mean the government in effect assumes more than half the cost of business aid to education. And they win gratitude for a voluntary and generous act.

Viewed in the broad public interest, the business community has an opportunity to perform a financial rescue mission in education which could well be the key to successful survival, not only of our present system of higher education, but also of the nation itself.

As previous editorials in this series have pointed out, a very small share of the net income of business firms — about 1% — would do the job. Certainly business must not be distracted from this opportunity by the new venture of the federal government in financial aid to education.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nation-wide developments. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

Donald C. McGraw

PRESIDENT

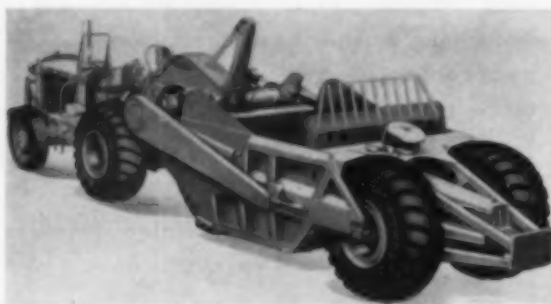
MCGRAW-HILL PUBLISHING COMPANY, INC.

Equipment Developments



Automatic Trip Holder

To eliminate the need for dangerous time-wasting manual manipulation of skids, The Nolan Co., Bowerston, Ohio, now offers the Nolan "Hold-A-Trip," designed for use with the Nolan "Port-A-Feeder" for automatically spotting mine cars. The Hold-A-Trip is mounted between the rails with a control hose from the Port-A-Feeder so that when the feeder is started oil pressure operates a cylinder on the tip holder to release the brake and permit the cars to move. When the feeder is stopped the brake on the Hold-A-Trip is set automatically. The standard unit has a brake capacity of 20,000 lb. Larger units are available to specifications. The Hold-A-Trip also may be used as a retarding unit with suitable manual or automatic connection to the brake lever.



Scrapers, Tractor Auxiliaries

Two new scrapers for service with the DW20 wheel tractor have been announced by the Caterpillar Tractor Co., Peoria, Ill., along with auxiliaries to ease tractor operation and maintenance.

The new scrapers are the No. 482 Series B (illustrated) with a truck capacity of 24 cu yd, with general application where loading conditions are good, grades are at a minimum and rolling resistance is low; and the No. 456 with a capacity of 18 cu yd for use primarily where adverse grades and high-resistance haul-road conditions are encountered. Both units include new features to insure long service life of components, including cable, and to promote safety in operation.

New tractor auxiliaries include a dry-type air cleaner for the DW20 and DW21 machines. It is made up of a disposable

resin-impregnated cellulose filter, multicyclone pre-cleaner, aluminum center tube, housing and collecting tray. It is fully effective at all engine speeds, the company notes, and removes 99.8% of all dirt from the intake.

For D8 machines Caterpillar offers a foot-operated decelerator to slow the engine without using the hand throttle, freeing the operator's hand for other control levers, permitting loads to be picked up slowly, facilitating positioning in tight quarters, and increasing the service life of certain engine components.

For track-type tractors, Caterpillar has developed a new seat best adaptable to all current and former models. Design provides secure holding ability with instant disengagement when desired, and increases operator safety and comfort in rough terrain.



Shovel-Crane Combination

Equipped with Lima "Precision" air control, two new shovel-crane-dragline units are offered by the Construction Equipment Div., Baldwin-Lima-Hamilton Corp., Lima, Ohio. As a shovel, the Type 64 machine has a 22-ft boom, 17-ft handle and a 1 1/4-cu yd dipper. As a crane, it is rated at 40 tons. The 64Sc is designed for special crane service and is rated at 50 tons. Power is gasoline, diesel or electric with torque converter.



1959 Truck Line

New economy, durability, styling and driver comfort are features cited by the Ford Div. of the Ford Motor Co., Dearborn, Mich., for its 1959 truck line, which features a full range of 371 models.

Heavy and extra-duty trucks are available in nearly 150

NEW ROOF BOLTING UNIT



drills roof and sets bolts in jig time trams itself anywhere

You get *new speed and new safety* with the RBD-30S-579. This roof bolting unit completes the whole bolting cycle from drilling to bolt setting in less than 3 minutes. *New* fully enclosed dual-wheel drive has separate tramping motor with push button control. Gives instant forward . . . stop . . . reverse.

This rig drills holes exactly right in size and direction. No dog-legs! No wobbling! No dwelling! That means safe,

positive bolt installation. *New* stepped-up motor gives you 30% more power for drilling and bolt setting. Built-in clutch slips on overload to prevent stalling.

New built-in cooling fan pulls heat away from enclosed motor, adds life to insulation. RBD-30S-579 furnished with low speed spindle adapter for slow speed drilling and low seam drilling attachment. Available with water swivel attachments. Write for complete details.



Chicago Pneumatic

8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

COAL AGE • December, 1958

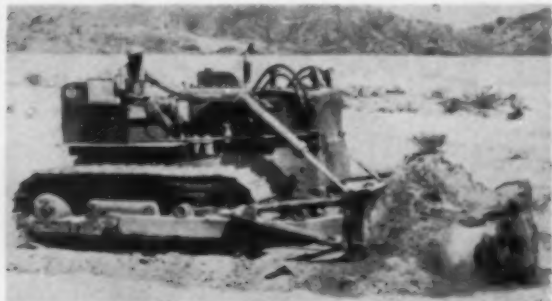
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Equipment Developments (Continued)

conventional, tandem and tilt-cab models. The extra-heavies include seven new tilt-cab models available on special order in gross vehicle weights from 37,000 to 51,000 lb, with GCW ratings up to 75,000 lb. Tilt-cab design facilitates engine attention, and eight rear tires provide extra flotation in deep mud or sand.

Ford offers six V-8s, including three Super Duty engines with displacements up to 534 cu in for its extra and extra-heavy trucks, accompanying them with new axle ratios and a wide range of power-train options for tailoring each unit to the job.

Power plants for the heavy "700," "750" and "800" series trucks include 187-hp, 196-hp and 212-hp units. "Driverized" cabs also are noted as an additional feature on all trucks.



Diesel Tractor

Introduction of the 105-hp TD-15 medium-sized crawler tractor has been announced by the International Harvester Co., Construction Equipment Div., Chicago. Among the features cited by the manufacturer are outstanding smoothness for the 6-cylinder engine; six-speed single-stick full-reverse transmission; and, as optional equipment, a foot decelerator.

Significant changes in the International Drott "4-in-1" Skid-Shovel have been made to match new TD-15 performance, the company notes. Features are: 2½-cu yd bucket with improved design to handle sticky material; heavier shovel frame and 20% stronger lift arms; increased reach of 36 in and lifting height of 12 ft; and greater pry-action breakout force, plus automatic "kick-out"—an adjustable cable control which can be set to stop lift-arm movement at any desired height.



Heat-Exchanger Motor; Motorized Gear Drives

A new DC heat-exchanger motor designed to provide a wide adjustable speed range is now offered by The Louis Allis Co., Milwaukee 1, Wis. The motor, with Class I Group D explosion-

proof enclosure, also is intended for constant-speed applications. Available ratings range from 25 to 300 hp, and standard enclosed construction for protection against dirt, moisture and other contaminants is available. The range of adjustable speed varies from 5% of base motor speed by armature control (constant torque) to 400% by field control (constant horsepower). The motor can be mounted floor horizontal, wall or ceiling horizontal, or vertical with shaft up or down.

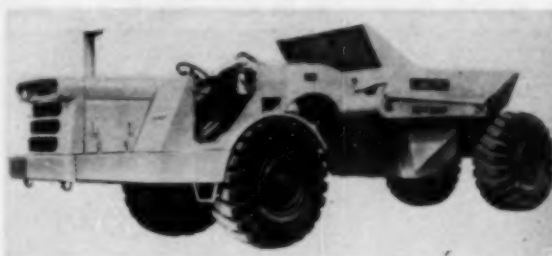
New "Line-A-Spede" motorized gear drives are another Louis Allis product. These drives (Bulletin No. 2350) are gear reducers powered by standard NEMA-frame motors mounted on a shelf attached to the reducers. The "Line-A-Spede" utilizes double, triple

and quadruple reduction units for ratios up to 1,487:1 with motor ratings of 1 to 75 hp. Motors of all types may be employed, and the drives may be mounted in any position.



Hydraulic Power Package

Wooster Div., Borg-Warner Corp., Wooster, Ohio, now has available a new



13-Ton Tractor Wagon

The 13-ton Michigan Model 110 tractor wagon extends the Michigan line of construction equipment to rear dumps, according to an announcement by the Clark Equipment Co., Construction Machinery Div., Benton Harbor, Mich. S.A.E. heaped capacity is 12 cu yd; struck capacity, 8.3 cu yd. Made of high-strength steel, the unit is designed for protection against damage in loading and for long life of body and other components. The tractor is identical to and interchangeable with the unit on the Michigan Model 110 scraper, and includes four-speed power-shift transmission; 3:1 multiplication torque-converter drive; dual-range power steering with 90-deg tractor turn; and a top travel speed of 31.4 mph.



38-Yd Scraper Combination

Combining the 600-hp M-R-S tractor with the matching M-R-S 250HW scraper, M-R-S Mfg. Corp., Flora, Miss., now offers a 38-cu yd unit with operating speeds up to 34 mph. An advanced-design hydraulic control is incorporated in the scraper design, which the maker also notes has "the lowest bowl in relation to capacity of any scraper on the market."



Traction Express tires give coal hauler up to 90,000 miles before retreading

THAT hopper-bottom trailer has just emerged from a coal-loading tunnel at Guntersville, Ala., ready for the 75-mile trip to Rome, Ga. It's one of a fleet owned by the Coal Transportation Co. that works 18 hours a day, 6 days a week, hauling 20-ton loads over winding, mountainous roads.

"We have a hauling job that is particularly hard on tires," says President Taft Chatham, "but we find B.F. Goodrich Traction Express tires give better service than any other make we have ever used!" Traction Express tires give this company up to 90,000 original miles—then 2 retreads! Blowouts and tread separations are almost unknown!

Like all B.F. Goodrich tires for mine

work, the Traction Express is built with a FLEX-RITE NYLON cord body. B.F. Goodrich FLEX-RITE NYLON withstands double the impact of ordinary cord materials, resists heat blowouts and flex breaks. No wonder this B.F. Goodrich construction outwears even the extra-thick Traction Express tread, can often be retreaded again and again.

See your B.F. Goodrich Smileage dealer today. He has B.F. Goodrich tires for your mining jobs that will save you money, give you longer service. Your dealer is listed under Tires in the Yellow Pages of your phone book. B.F. Goodrich Tire Co., A Division of The B.F. Goodrich Co., Akron 18, Ohio.

Specify B.F. Goodrich Tubeless or tube-type tires when ordering new equipment



B.F. Goodrich *truck tires*

COAL AGE • December, 1958

© The B.F. Goodrich Company

Equipment Developments (Continued)

line of self-contained power packages producing hydraulic power from an electric source. The package incorporates an electric motor, hydraulic gear pump with integral relief valve, check valve and reservoir in one assembly. Capacity of the gear pump ranges from 0.36 to 0.80 gpm. Reservoir capacities range from 0.43 to 1 gal. The reservoir also serves as the pump housing. The motors are available for operation from a 6-, 12-, or 24-V source. Shaft rotation is available for operation in either direction, or can be reversible.



Ball-Actuated Valve

Hunt Valve Co., Salem, Ohio, has introduced a new ball-actuated spring return valve. Only 1 in thick and 3 in wide, the valve can be used for air, oil, or water service with pressures to 125 psi and temperatures to 150 F. The valves are furnished tapped for either $\frac{1}{4}$ - or $\frac{1}{2}$ -in pipe connection. The ball actuator can be depressed from any peripheral point of 360 deg as long as the valve plunger is given its full $\frac{1}{2}$ -in travel. Hunt says these valves can be manifolded together easily and quickly without requiring any special parts. Eight valves can be operated simultaneously from a single air supply, or up to 16 valves simultaneously from two supply lines.



Dual-Duty Bearing

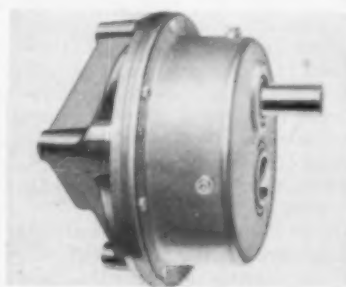
This dual-duty cylindrical roller bearing, made by Rollway Bearing Co., Syracuse, N.Y., is designed for applications where both thrust and radial loads must be carried in a restricted space.

Actually two bearings in one, the unit consists of two roller assemblies (radial and thrust), with the flanged inner race of the radial section serving at the same time as the revolving plate of the thrust section. Rollway says bearing ratings on a standard size of 6 $\frac{1}{2}$ -in OD and 3 $\frac{1}{2}$ -in bore are: at 100 rpm the radial capacity is 3,150 lb and thrust capacity is 24,600 lb; at 1,750 rpm radial capacity is 1,340 lb and thrust capacity is 9,500 lb.



Four-Axle Truck Crane

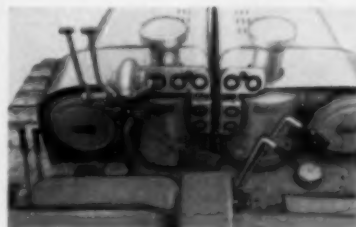
The Construction Equipment Div. of Baldwin-Lima-Hamilton Corp., Lima, Ohio, is now in production of a new four-axle 50 ton capacity truck crane known as the Type 64-T. The carrier is of Lima design and is available in 8 x 4 and 8 x 6 drives. Outstanding in the carrier construction is the use of T1 steel (100,000 psi yield strength) in the main frame and frame components. Crane booms are extendible to 150 ft or 180 ft, including jib. The rotating assembly is of heavy duty design and features air control for all motions, gasoline or diesel engine with torque converter, and a power raised and lowered telescoping back hitch gantry.



Attached Gear Drive

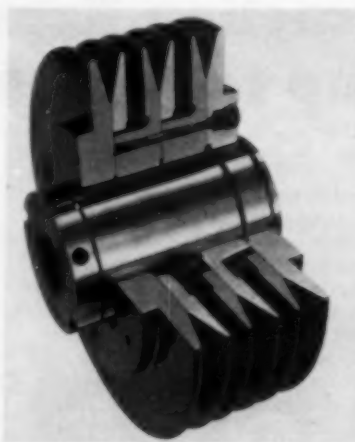
This gear drive from Falk Corp., Milwaukee, bolts directly to the driven machine. Falk says the unit is designed with bearing capacities for overhung and thrust loads to allow installation of the drive into the driven machine as a geared pillow block, if desired. The flange mounted drives are built to Amer-

ican Gear Manufacturers Assn. recommendations and are available for horizontal or vertical applications, with high speed shaft up or down. The units are furnished from stock in single reduction for applications of $\frac{1}{2}$ to 10 hp, and in two double reduction ratios for $\frac{1}{2}$ to 5 hp.



Tractor Air Cleaners

Current production models of the new series Euclid TC-12 tractor are equipped with two Donaldson dry-type air cleaners—one for each engine, according to Euclid Div., General Motors Corp., Cleveland. Replacing four oil-bath units, these new units are said to be 99.9% efficient and much easier to service. The primary cleaner has a removable dust cup that can be emptied and cleaned quickly. A special paper element in the secondary cleaner has long service life because it is easily cleaned by compressed air or washing and replaced in the filter chamber.



Adjustable-Speed Sheave

A new simplified design of stationary control adjustable-speed sheave—the "Adjuster"—has been introduced by Allis-Chalmers Mfg. Co., Milwaukee 1, Wis. Adjustment is made through a single adjusting screw and a hollow lock screw. Relative position between stationary and movable disks is positively

"We bought 1 Tournatractor[®] to replace 2 crawlers"

says pit manager James W. MacDonald

At their Lynchburg Stone Division Pit in Concord, Va., Rockydale Quarries Corporation produces up to 2,000 tons of crushed limestone daily. To meet production requirements, 2 crawler-tractors were used on scattered maintenance assignments around the pit and plant. Since distances between the multiple-tractor jobs ranged up to 1/2 mi., the slow-moving crawlers lost valuable work-time when traveling job-to-job. What's more, track maintenance ran high because of travel distances over the abrasive footing.

So Rockydale Quarries looked for a more economical type of tractor. They found it in the rubber-tired LeTourneau-Westinghouse Tournatractor. Says pit manager James W. MacDonald, "We bought 1 Tournatractor to replace 2 crawlers, and also to cut track repair costs. It's very successful... we like its speed and versatility."

All-around handyman tool

Lynchburg Stone Division Pit uses their Tournatractor—equipped with 14'10" long Angledozer[®] blade—as an all-around handyman tool (note sketch). This speedy, rubber-tired tractor cleans-up after blasts and around shovels. It handles general dozing, moves wagon-drills on pit rim, assists stalled trucks, and maintains stockpile. When shovel at plant is down for repairs, Tournatractor takes over... pushes rocks from surge pile to hopper, to insure uninterrupted plant produc-



Tournatractor quickly clears blasted rocks from watery pit floor. Operator Rodney Arthur says, "Tournatractor is easy to operate. It's powerful, runs good and is fast. With a crawler it used to take me 16 min. to go from pit to plant... but with Tournatractor it takes only 2 or 3 min."

tion. Rubber-tired tractor also is used to push-load pit's Handyman D Tournapull[®] scraper on stripping and road-building operations.

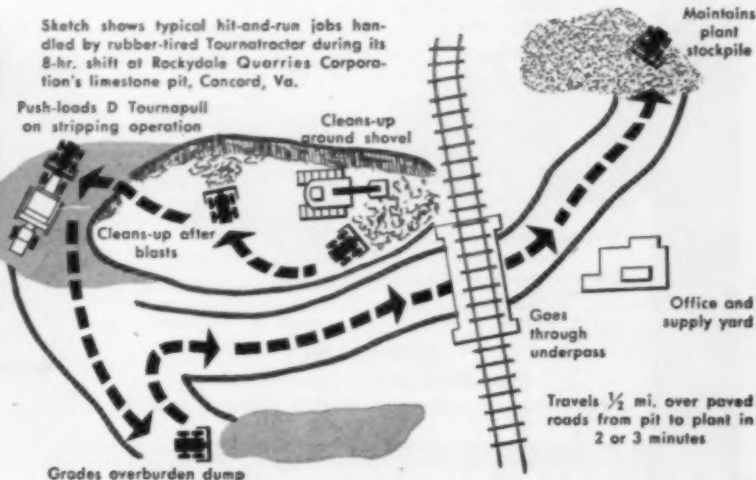
Commented pit foreman Jabe S. Ferguson Jr., "We're all strung out between quarry, plant, and stripping-ends on quarry rim. The Tournatractor hustles back and forth... works all over the place. It does a good job."

Try Tournatractor at your pit

If your pit operation is widely scattered or involves abrasive material, why not investigate rubber-tired LeTourneau-Westinghouse 210 hp Tournatractor? You'll find this speedy tractor completes scattered jobs faster, at lower cost. Let us arrange to demonstrate versatile Tournatractor at your pit. No obligation.



Between dozing assignments, 210 hp Tournatractor push-loads 7 1/2-yd. D Tournapull (new "D" has 9-yd capacity) with red and blue clay overburden. Pit also owns a L-W Rear-Dump hauler which is easily interchanged with scraper... increases "D" prime-mover's usefulness.



CT-1707-QMJ-1

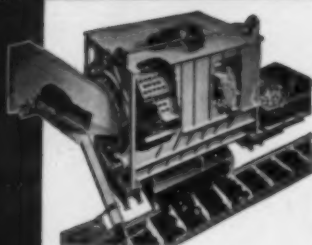


LETOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

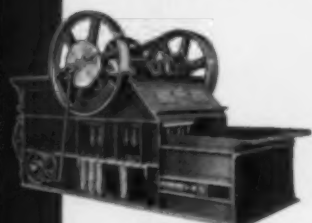
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America's most
complete line of
CRUSHING EQUIPMENT



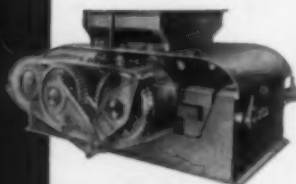
**McNally Pittsburgh
Rotary Breaker**

This unit allows positive control of top size in handling run-of-mine washery feed. Production of fines is held to a minimum.



**McNally Norton Vertical
Pick Breaker**

50% Less fines when reducing lump to egg and stove sizes.



**McNally Double Roll
Gearmatic ROM Breaker**

Built in tonnage ranges from 750 tph to 1400 tph. Full floating gearmatic drive.



**McNally Gearmatic Stoker
Coal Crusher**

This unit offers three prime advantages: high volume production, plus accurate sizing, plus low percentage of fines.

Equipment News (Continued)

maintained at all pitch diameters without desk-to-main-sleeve setscrews. The sheave is available for A, B and C section belts in two-, three- and four-groove construction. Design capacities up to 75 hp are covered by 33 sizes. Economy in installation and operation is the major advantage cited by Allis-Chalmers.



Faster-Change Bit

The new Carbology CC-7 machine bit now offered by the Metallurgical Products Dept. of the General Electric Co., Detroit, is said to provide these advantages: forged-steel shank half again as large and tapered to fit solidly in the holder; no lug bolts for faster bit change, more bits in a block and ability to produce with less overloading and longer life even with the increased number; full-radius Carbology tip to protect the tool from rubbing and undue wear, even under coring conditions; a flat fitting a positioning mechanism to prevent turning or rotation; and less bending and breakage, with more production in hard cutting, as a result of the heavier shank.



McNally Single Roll Crusher
Universal application 20", 24"
and 36" diameter rolls.

AVAILABLE

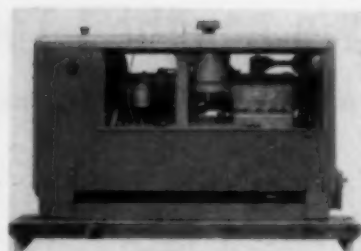
From Stock and on Short Delivery

For immediate action on complete information write, wire, or call.

McNALLY PITTSBURG MFG. CORP.

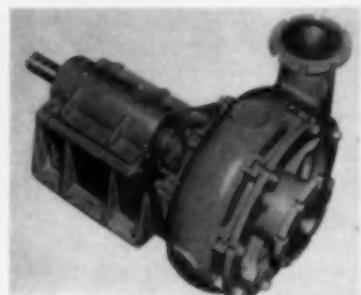
Pittsburg, Kansas

Wellston, Ohio



Truck Compressor

A special 125-cfm compressor, for cross-mounting on motor trucks, has been announced by Davey Compressor Co., Kent, Ohio. Known as Model 125-RP Hydrovane rotary skid, the new unit features a compact weatherproof control panel mounted on the curb end of the compressor. Its location, adjacent to clutch lever and air outlets, permits one-man operation of the machine. The Model 125-RP is 81 in long, 34 in wide, 51 in high, and weighs 2,300 lb. It is powered by a Hercules GO-198 engine.



Solids Pump

As a heavy-duty low-speed centrifugal unit, the Model CK solids pump has been added to the line of the Morris Machine Works, Baldwinsville, N. Y. It is especially designed, the manufacturer states, to handle fluids containing random-sized solids and highly abrasive materials: i.e., a 6-in pump efficiently handles 4x $\frac{1}{2}$ /8 solids. The pump is available in 4-, 6-, 8-, 10- and 12-in sizes in semisteel, Nihard, cast steel or manganese steel.



Conveyor Chain

A new and stronger flight design and greater chain strength are cited by The

Load-out more per shovel

In the loading zone,
Tournapull® Rear-Dumps
reduce shovel waiting,
cut load-time . . . handle
more loads per day



You'll load-out more per day, when your shovels load into LeTourneau-Westinghouse Tournapull Rear-Dumps. These husky haulers speed your load-haul-dump-return cycle in many ways. Here's how Tournapulls boost output by saving time in the loading zone.

Faster spotting at shovel

Rear-Dump eliminates slow back-and-forth maneuvering to spot, while your shovel sits idle and waiting. Tournapull operator can swing prime-mover 90° . . . make sharp turns to maneuver quickly into best loading position. Tournapull's quick maneuverability adds time for extra payloads . . . saves preparation of turn-arounds . . . shortens cycle.

Turns 180° in tight quarters

With 90°-turn, geared electric-steer on kingpin, your Tournapull opera-

tor can make fast, tight U-turns at the shovel . . . in dead-end cuts, in narrow pits, in tunnels, on restricted benches. This frequently saves long, slow back-in . . . eliminates delays for shuttling into tight positions. A 22-ton model "C", for example, can turn 180° to spot in a dead-end cut less than 21' wide. All L-W haulers make continuous U-turns in less than their own length. And with body "up", they can turn 180° in 25% less than their length.

Big, easier-loading bowl

Rear-Dump's broad bowl is an easy-to-hit target—one that lets your shovel operator spot dipper fast, for quick dump without spillage. He swings the bucket thru bowl's low rear entry in a smooth, continuous arc . . . there's no time wasted on jerky up-down-up-and-out motions.

Exclusive . . . Tournapull steering

Only Tournapulls give you geared, electric-powered, 90° kingpin steer. At touch of a dashboard switch (or movement of steering wheel on 35-ton unit), an electric motor pivots prime-mover on the kingpin. Safety limit switch stops turn at 90° angle.

The rugged triple-strong body is so tapered that it takes shock loads easily, quickly builds a protective bottom load cushion. Because long drive-shaft is eliminated, unit also gives you an exceptionally low center of gravity for safe, fast hauling.

Steady, low-cost earthmoving

Tournapull Rear-Dumps take on full payloads fast, maneuver easily, haul steadily on or off roads, and dump clean in seconds. They're easy to operate and extra safe on soft fills and over-bank dumps . . . on steep hills . . . on narrow, winding roads. Tournapull's simple construction cuts maintenance downtime, reduces cost per ton.

Get all the story . . . it's important to you! Call or write for complete details on Tournapull Rear-Dumps.

R-1461-DC-1



Three profit-building sizes

	Model B	Model C	Model D
Ton Capacity . . .	35 net tons	22 net tons	11 net tons
Bulk Capacity . . . (heaped 1:1)	31 cu. yds.	22 cu. yds.	10.5 cu. yds.
with tailgate	33 cu. yds.	24 cu. yds.	11 cu. yds.
with sideboards . . .	not offered	28 cu. yds.	not offered
with tailgate and sideboards . . .	not offered	29 cu. yds.	not offered



LETourneau-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

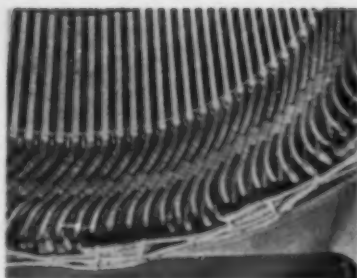
Where quality is a habit

Equipment News (Continued)

Long Co., Oak Hill, W. Va., as the major features of improved "Superflite" No. 4452 12-in conveyor chain. Average ultimate strength of 27,000 lb is said to be 37½% more than other 2,307-in-pitch chains and 12½% greater than the original "Superflite" L-80 chain. Other features include easier assembly, longer life and improved conveying efficiency—flights stay straight and run free even in extra-heavy-duty service. Interchangeable with chains used on all 12-in conveyors, No. 4452 is obtainable in standard bundle lengths of 12 ft 3½ in, weighing 67 lb.

Weather-Protected Motors

"Polyseal," a silicone-rubber insulation system that seals out moisture and "could eventually change many conventional motor-application practices," is now available on many of its form-wound motors, says the General Electric Co., Schenectady 5, N. Y. "Elimination of costly protective enclosures on many existing-type motors might be the eventual result of a sealed insulation system of this material." The system is offered at Class B temperatures, which are well below its thermal capacity. This adds to motor life. Other advantages noted by

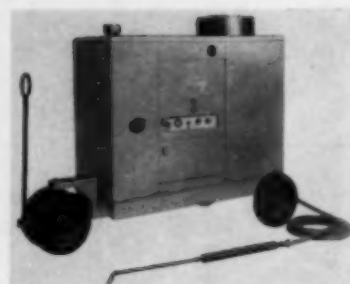


G. E. include: low dielectric losses, long voltage endurance and resistance to mechanical abuses in operation. Motors containing the "Polyseal" system are available in most form-wound sizes from 150 to 1,750 hp.

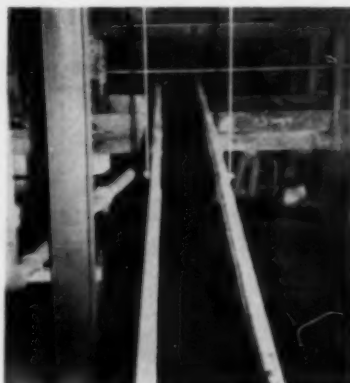
A new line of NEMA Type II vertical weather-protected motors for heavy-duty applications also is announced by G. E. The line is designed for year-around use under severe weather conditions. In all typical configurations, the motors are rated up to 5,000 hp.

Steam Cleaner

Six times faster cleaning of heavy machinery and equipment is claimed for the new "3500" Series Hypressure Jenny—a steam-hydraulic unit made by the Homestead Valve Mfg. Co., Coraopolis, Pa. Instant choice of eleven different



cleaning actions is said to be available by the movement of a single lever. A 350-gph pump delivers the amount required for any specific job, and outlet pressures and temperatures are variable by the operator up to 300 psi and 325 F. The cleaner comes in trailer-mounted, shop-portable or stationary models, with a choice of oil or gas as the fuel.



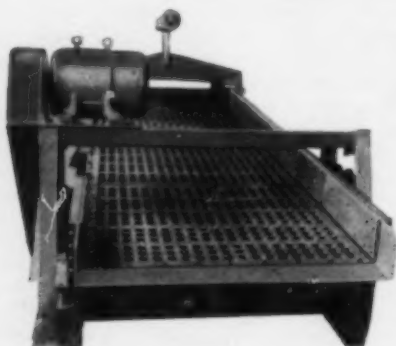
Chute Lining

An increase in compressive strength to 12,000 psi is among the improvements noted for Stonpach chute lining material by the Stonhard Co., Philadelphia 23. Stonpach is a dry granular powder to which water is added at the job site. It may be installed by unskilled labor. In the improved product a finer and harder aggregate and a new metallic reinforcement have been added.



Steel-Cord-Breaker Tire

Describing it as "the first pneumatic industrial tire with steel-cord breaker



**Here's
the plate
that takes the pounding**

Hendrick H Quality Steel Plate Screens Coal Easier, Faster, Lasts Longer

Hendrick H Quality Steel Perforated Plate, made from heat-treated high carbon or stainless steel, are your best replacements. This carefully-developed metal is tough and rugged under continuous and heavy use. It screens coal easier and faster, while full clearance

reduces downtime due to blinding. Product uniformity is assured throughout the life of the screen.

Order Hendrick H Quality Steel with either flat, corrugated, or stepped surfaces, in any desired shape and with any size of perforation. Whatever you order, you get Perforated Plate which reflects Hendrick's 82 years of experience in selecting the kind of steel the mining industry needs.

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Perforated Metal • Perforated Metal Screens • Wedge-Slot Screens • Hendrick Wedge Wire Screens • Architectural Grilles • Mitee Open Steel Flooring • Shur-Site Treads • Armorgrids • Hydro Dehozers • Distillation Column Internals

Where the going gets rough...

get tough

with Lukens "T-1" Steel!

TRADE-MARK



WRITE FOR THIS BOOKLET TODAY



■ Wherever rock and gravel, coal and ores come in violent contact with machine and equipment parts, Lukens "T-1" steel—especially extra tough 321 min. BHN quality—fights back at wear and abrasion with spectacular success.

It is readily fabricated. You can form or weld it in the field or shop, from stock plate sizes immediately available. It can be used to replace or repair worn bucket teeth, truck and mine car bodies or liners, dozer blades, dipper sticks, crusher teeth, chutes, and many other parts.

Far stronger for its gage than conventional steel, it requires less metal to do equivalent jobs. It remains tough even at sub-zero temperatures.

Contact your nearest warehouse listed below, or write Manager, Marketing Service, 139 Lukens Building, Lukens Steel Company, Coatesville, Pennsylvania. Ask for special bulletin, "Lukens 'T-1' for Toughness."

WAREHOUSES

Ashland, Kentucky, Mansbach Steel Co., 19th St. & River Front	Cleveland 6, Ohio, Mills-Wolf Steel Co., 10006 Carnegie Avenue
Baltimore 2, Maryland, Wm. G. Wetherall, Inc., 317 President Street	Los Angeles 33, California, The R. J. M. Company, 238 Mission Rd.
Birmingham 2, Alabama, O'Neal Steel, Inc., P. O. Box 2623	Montreal, Quebec, Can., Drummond, McCall & Co., Ltd., 930 Wellington St.

HELPING INDUSTRY CHOOSE STEELS THAT FIT THE JOB

HINGED PLATEGRIP

BELT FASTENER No. 500

FOR HEAVY CONVEYOR BELTS OF CHANGING LENGTH

These heavy-duty belt fasteners make a strong, flexible joint in conveyor belts, belts of any width and of from $\frac{3}{8}$ " to $\frac{1}{2}$ " thickness. They offer special advantages in mines, quarries or industrial setups where length or position of belt is frequently changed, because sections can be removed or added at will. Joints are opened for this purpose by simply pulling out the hinge pin.

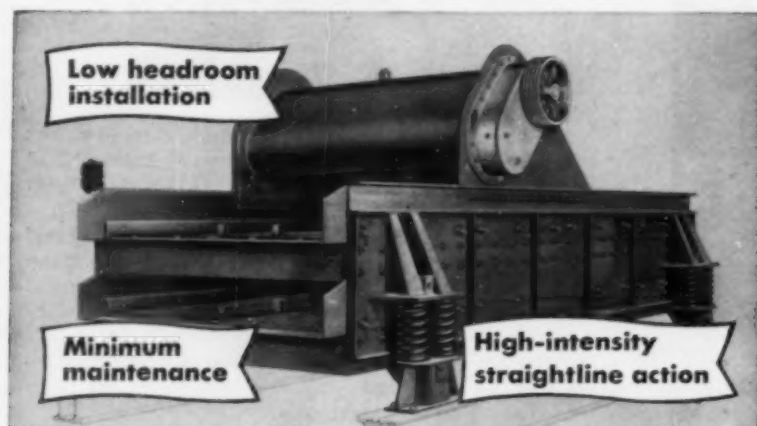
Easily and quickly applied on the job or in the shop. Special design gives deep compression into belting and smooth, flush joint.

Write for Circular



ARMSTRONG-BRAY & CO.
5340 Northwest Highway, CHICAGO 30, U. S. A.

NEW LINK-BELT STRAIGHTLINE horizontal vibrating screens



For dewatering, washing and sizing of materials—Link-Belt Straightline horizontal vibrating screens assure maximum capacity for size of screen cloth.

A centrifugal force, unbalanced shaft vibrator produces the high-intensity motion necessary for efficient separation. Suspension or floor mounted, these lower profile units can be installed in locations where headroom is limited. To learn more about the benefits of horizontal screening, call or write your nearest Link-Belt office.

LINK-BELT VIBRATING SCREENS

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarborough (Toronto 13); South Africa, Springs. Representatives Throughout the World. 14,678

Equipment News (Continued)

construction," Goodyear Tire & Rubber Co., Akron, Ohio, offers its "Steel Guard Industrial" product for mine and other use where sharp puncturing objects are a hazard. Produced in the "Super Rib" and "Industrial Lug" designs, the tire is available in these sizes: "Super Rib," 4.80/4.00-8, 6-ply rating; "Industrial Lug," 10-ply, 6.00-9, 6.50-10, 7.50-15; 12-ply, 7.00-12, 7.50-10.



Antifriction Lubricants

Two new antifriction lubricating compositions said to have no melting or dropping points are announced by the Whitmore Mfg. Co., Cleveland 4. They are specially designed for "hot" bearings

and trial samples (specify type) are available without charge. No. 1, light density, is recommended for high-speed high-temperature applications; No. 2, heavier density, low-speed high-temperature spots or loosely fitted bearings. Both are available in 14½-oz cartridges or bulk containers. Other features noted by the maker include high moisture resistance and chemical stability, exceptional adherence, high E.P. values and temperature-reducing qualities.

Equipment Shorts

INSULATION TESTING—Hewson Co., Newark, N. J., has developed a DC insulation test instrument that tests and evaluates insulation condition on large motors, generators, transformers, cables, and high voltage electronic assemblies. The instrument, VON 100 KV has a 5 milliamper output at 100,000 volts. The tester also is available in 150 KV, 200 KV, and 250 KV ratings.

FLEXIBLE PIPE—A new flexible polyethylene pipe announced by Carlon Products Corp., Cleveland, is said to defy stress cracking. Called Hi-Mol, the pipe is available in sizes $\frac{1}{2}$ through 2 in in both schedule 40 IPS and 75 lb pressure rated. The pipe also is available in sizes 3 to 6 in. According to Carlon, Hi-Mol can be used with most chemicals where operating temperatures are as high as 150 deg F.

HOSE AND COUPLINGS—Alemite Div. of Stewart-Warner Corp., Chicago, has added another combination to its line of hose and couplings. The newcomer, "Shur-Lock," has hose and coupling assemblies that can withstand working pressures up to 250 psi. It will handle a wide variety of materials. Minimum burst pressure is 1,000 psi.

PLASTIC RESPIRATOR—Protection against dusts, pneumoconiosis-producing mists and chromic acid mists is claimed for 2.1-oz "Air-Raider" with Bureau of Mines Approval No. 2175. Unit made by Welsh Mfg. Co., 52 Magnolia St., Providence 9, R. I., features a filter of treated-wool electrostatic type, four-point suspension straps and frame cushion to fit wide variety of face shapes and head sizes.

BOOM AND JIB—Link-Belt Speeder Corp., Prudential Plaza, Chicago 1, Ill., offers new "Hi-Lite" boom and jibs that add from 20 to 60 ft in usable height to former crane boom designs. New units are designed for maximum boom and jib lengths up to 200 ft. Square tubular chords and round tubular internal cross bracing are of high-strength, lightweight

tubing to provide extra strength. Other features include pin connections, extender cables that permit changing the length of the boom without changing boomhoist cables and an open-throat design that prevents interference with the cable when working at short radii.

HYDRAULIC JACKS—Two new high-lift hydraulic jacks have been added to the Simplex line by Templeton, Kenly & Co., Broadview, Ill. Both have capacity rating of 25 tons and are equipped with high- and low-speed pumps which may be operated singly or in unison. Model 25H28 has a closed height of 28 in and a 22-in lift. Model 25H22 has a closed height of 22 in and a lift of 16 in.

DIAPHRAGM PUMP—Denver Adjustable Stroke Diaphragm pumps now are available in a full range of sizes from 1-in simplex to 10-in duplex in capacities from 2½ to 1,000 gpm. A new improved diaphragm makes possible up to 75% higher capacity, the maker says. Other distinctive features are antifriction bearings, simplified drive using standard motor and improved hand-wheel adjustment to change length of stroke. Full information from Denver Equipment Co., P. O. Box 5268, Denver 17, Colo.

DIAMOND DRILL—CP-65 is a new and powerful diamond drill introduced by Chicago Pneumatic Tool Co., 6 East 44th St., New York 17, N. Y. A new high-torque motor packs 50% more power for drilling to depths of 600 ft with ordinary mine air pressures. The motor is reversible to speed drill changes. The fully-enclosed unit is dusttight and oiltight. The complete drill is 42½ in long and weighs 200 lb.

Free Bulletins

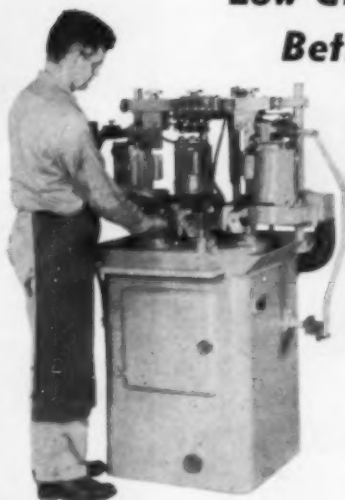
V-BELT DRIVES—"How to Get Longer Life From V-Belt Drives," is title of new 12-p illustrated manual, issued by B. F. Goodrich Industrial Products Co., Akron, Ohio. Manual tells how to select and install V-belts, how to detect trouble and diagnose failures and how to correct drive troubles. Maintenance checklist also is included.

REDUCED-VOLTAGE STARTER — Design and construction of automatic reduced-voltage starters are described in new Bulletin 14B8192, available from Allis Chalmers Mfg. Co., Milwaukee 1, Wis. Covers starters from 50 to 1,200 hp, 600 V, with regard to theory and operation.

POWER TRANSMISSION — Bulletin 3101, by T. B. Woods Sons Co., Chambersburg, Pa., covers complete line of

Low Grinding Costs Better Performance

Fast Production Uniform Results Maximum Bit Life



These are a few of the many advantages you get when you grind your bits automatically on the FAIRVIEW BIT GRINDER.

All of these advantages boil down to savings of both labor and wheels, productivity of 250 to 350 per hour, correct angles—smooth finish, more regrinds, more grinds per bit, more tons per grind and elimination of hazardous operation. It's to your advantage to use the FAIRVIEW BIT GRINDER both in the satisfactory grinding results obtained and in the protection of your investment in expensive equipment.

**WRITE TODAY
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FAIRVIEW BIT COMPANY

FAIRVIEW, WEST VIRGINIA

Guyan
HEATERS

FOR CONFINED AREAS

ALSO AVAILABLE IN FLOOR TYPE



**RUGGED
and ECONOMICAL TOO!**

WHEN the space is hard to heat — such as a crane or locomotive cab, a pump house or small office — a GUYAN natural convection heater is the answer. It is a **DEPENDABLE, LONG-LIFE HEATER** consisting of corrosion-resistant aluminum chromium wire — wound on ceramic forms — and mounted within expanded steel housings. GUYAN Heater Units are ruggedly built to stand the hard service that is customary in tough industrial applications. Available from 1,500 thru 7,500 watts for 110, 220, 440 volts DC or AC. Priced right — more economically than you might think — and lower than you can make your own. Write for complete information.

GUYAN MACHINERY CO.
LOGAN, WEST VIRGINIA

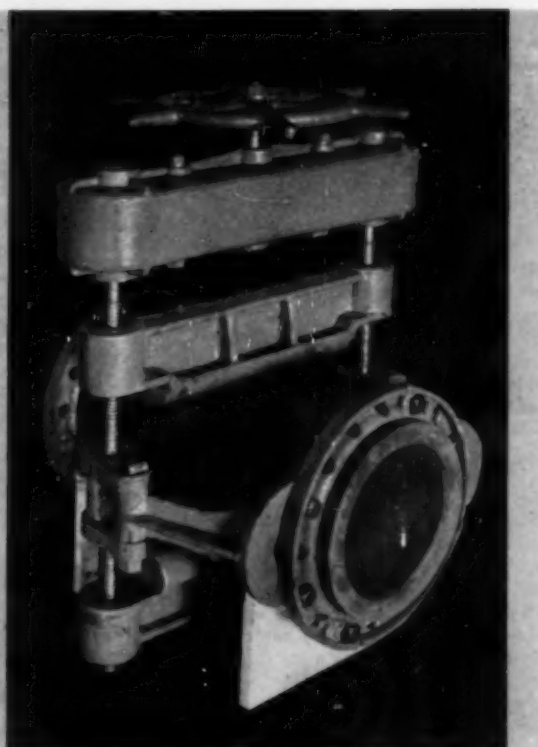
Guyan
HEATERS

Massco-Grigsby

PINCH VALVES

for the coal industry

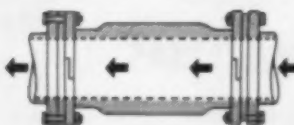
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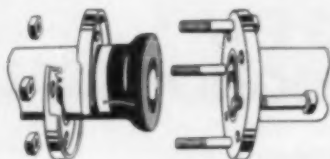
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Equipment News (Continued)

sheaves, variable-pitch sheaves, V-belts, flat-belt pulleys, pillow blocks and so on.

OIL PRODUCTS—New 11-p booklet, from Sun Oil Co., Industrial Products Dept., 1608 Walnut St., Philadelphia 3, Pa., gives information on Sun's general and specialty lubricants, greases, mine lubricants, machining oils and other products.

TRACKWORK—Railroad Products Div., American Brake Shoe Co., 530 Fifth Ave., New York 36, N. Y., offers 8-p brochure on trackwork for mines and other industries, including specifications for frogs, turnouts, guard rails, switch stands and so on. Also included is a section on ordering.

DRILLING TOOLS—New 24-p Catalog No. 358 contains illustrations and specifications of carbide drill bits, drill rods, moil points and other tools, with suggestions on how to get more life and service and how to sharpen and harden tools. Write Brunner & Lay, Inc., 9300 King St., Franklin Park, Ill.

HYDRAULIC COMPONENTS—Bulletin 1502 reviews directional control valves, accumulators, cylinders, hose assemblies and tube fittings. Write E. C. Davis, Parker Hydraulics Div., Parker-Hannifin Corp., 17325 Euclid Ave., Cleveland 12, Ohio.

ROOF BOLTS—Complete line of Republic roof bolts and accessories is described in 8-p folder. Advantages of Republic's roof-bolt certification program and on-the-site engineering service are pointed out. Installation procedures for various bolts are explained. Copies available from Republic Steel Corp., Advertising Div., 1441 Republic Bldg., Cleveland 1, Ohio.

GASOLINE ENGINES—Five revised bulletins provide basic installation diagrams, general data, power charts and detailed specifications on 6-cylinder, L-head engines made by Hercules Motors Corp., 101 11th St., S. E., Canton 2, Ohio.

REAR-DUMP HAULER—4-p folder gives dimensions, specifications and performance data on new 22-ton Easton-Euclid S-12 rear-dump hauler. Write Easton Car & Construction Co., Easton, Pa.

TWO-WAY RADIO—Pocket-size booklet describes latest standard models of two-way radio and optional equipment for individual system flexibility. Included are transistor models. Available from Communication Products Dept., General Electric Co., Syracuse, N. Y.

RADIAL SCREEN—New 8-p bulletin, offered by Nolan Co., Bowerston, Ohio, describes Nolan radial screening system for dewatering. Capacities and dimensions of eight models are listed, in capacities from 30 to 220 tph.

VALVES—Ohio Brass Co., Mansfield, Ohio, offers condensed catalog covering its complete line of bronze, globe, angle, check, gate, radiator and specialty valves, with respect to ratings, recommended uses, features and roughing-in dimension for each valve.

TRACTORS—Catalog CR-1374-H, avail-

able from Consumer Relations Dept., International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill., describes complete line of wheel tractors ranging from 12 to 72.5 hp. Catalog stresses special features such as new engines, torque-amplifier drives, fast reversing and so on.

FLEXIBLE CONNECTORS—Cobra Catalog No. 658 gives prices, specifications and installation procedures on line flexible pipe connectors in steel, stainless, monel or nickel. Write Cobra Metal Hose, 5059 S. Kedzie St., Chicago 32, Ill.

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Among the Manufacturers



Louis G. Helmick, executive vice president, Joy Mfg. Co., Pittsburgh, Pa., was recently elected a director of the company.

Mr. Helmick joined Joy in 1947 and was named executive vice president in

June, 1958. Prior to that time he had served as vice president and general manager of Joy's Industrial Div. Mr. Helmick is a 1943 graduate of Cornell University and a World War II veteran of the U. S. Army. He is a member of the American Society of Tool Engineers and American Management Association.

Election of Earl A. Bradley as vice president of National Mine Service Co., Pittsburgh, has been announced by Gordon MacVean, president of the company.

Mr. Bradley's new responsibilities include supervision of the company's three manufacturing divisions, Ashland, Clarkson and Greensburg. Mr. Bradley has supervised the expanding TorKar program and extensive rebuilding operations on a wide range of heavy mining equipment. His career in the industry began in 1937 with Consolidated Coal Co., Staunton, Ill. His headquarters at present are at the Ashland, Ky., plant of National Mine Service.



Earl C. Payne, for many years a consulting engineer with Consolidation Coal Co., is president of Mineral Mills, Inc., a new processor of magnetite with plant and headquarters at Pittsburgh, Pa.

Mineral Mills has acquired the magnetite operations previously conducted by Orefrac, Inc., of Pittsburgh. While with Consolidation Coal, Mr. Payne

SIMPLEX MINE JACKS

6 WAYS BETTER

- ★ Ratchet lowering lever type for speed with safety
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Combines safety of screw jack with fast action of crank. Head swivels. Five models with min. ht. from 3'6", max. ht. to 9'6".



Gear Cover
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Bevel Gears
and Crank
Twice as Fast
as Lever
Nut Type

3 TYPES OF HEADS



Type "F"
10 1/2" wide



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8 1/2" wide



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Manufacturers (Continued)

concentrated on equipment and coal application problems. He was among those instrumental in establishing the Fairmont Coal Bureau in 1942.

Howard Freyensee has been appointed manager of sales, large excavators, by Bucyrus-Erie Co., S. Milwaukee, Wis.

He succeeds L. C. Black, who recently was named manager of domestic sales. Mr. Freyensee formerly was sales-development manager for commercial cranes and excavators. He joined the company in 1946, and has served as sales representative in the Chicago and Atlanta areas. He is a graduate of DePauw University, Greencastle, Ind., and a Navy veteran of World War II.

Nordberg Mfg. Co., Milwaukee, has announced the appointment of Robert C. Meaders as assistant manager of the Mining, Crushing and Process Machinery Div.

Mr. Meaders was formerly associated with Carborundum Co., Niagara Falls, N. Y., as a research and mineral dressing engineer and with Patino enterprises as plant superintendent of Bolivian tin operations.

James M. Miles has been named manager of the Springville, Utah, industrial explosives plant of American Cyanamid Co.

A graduate of Pennsylvania State University, Mr. Miles has been with American Cyanamid since 1937 when he joined the company as a chemist at the New Castle, Pa., plant. Since 1954 he had been assistant plant manager at New Castle.

P. H. Mulcahy has been named general manager of Wemco, Div. of Western Machinery Co., San Francisco, Calif.

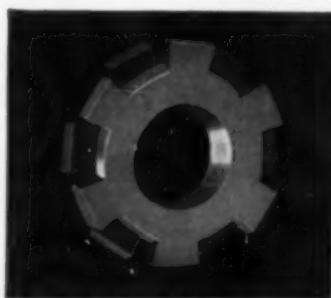
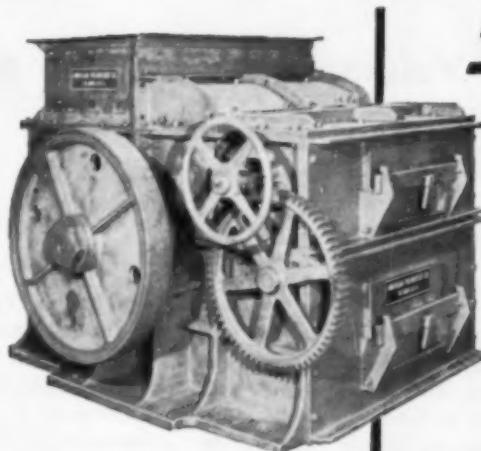
Prior to assuming his new position Mr. Mulcahy was vice president and general manager of Rietz Mfg. Co., Santa Rosa, Calif., and West Chester, Pa. He is a graduate of Stanford in electrical engineering. In his new position, Mr. Mulcahy will administer Wemco's present world-wide operations and be responsible for continuing its current expansion program.

Don V. Stone has been appointed manager of the new Kelley Ripper Div., Crutcher-Rolls-Cummings, Inc., Houston, Tex.

Because of an increasing market for the heavy-duty, tractor-mounted Kelley rippers, the new division of C-R-C was organized to serve in the promotion and sale of rippers through Caterpillar dealers throughout the world. Prior to his new appointment, Mr. Stone was in sales work for Caterpillar Tractor Co. for 19 yr.

BETTER COAL CRUSHING CONTROL BECAUSE IT'S BUILT BETTER . . .

American ROLLING RING COAL CRUSHERS



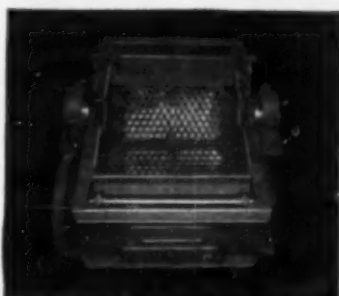
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Index to Volume 63 January to December 1958

COAL AGE

The articles and references compiled in this index have been listed alphabetically. A subject related to a major topic has been listed under the major topic. For example, an article dealing with a new mining machine and its operation will be found under the topic, "Mechanization." An article on shuttle cars will be

found under "Transportation." Unclassified articles, or those that cannot be placed in any major category, have been listed within the index alphabetically. Editorials, marked (E), will be found under the subject with which they are concerned. Many titles are abbreviated to give prominence to important words.

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- 1-824 Goodman, 42" t.g.
- 1-29U Jeffrey, 250 Volt
- 1-29U Jeffrey, 220/440 Volt, A.C.
- 35-35B & 35B6 Jeffreys, A.C. & D.C. Bugbusters and Trucks Available

LOCOMOTIVES

- 2-20 Ton MH77 Jeffreys, 42" t.g.
- 1-15 Ton Westinghouse Locomotive, unit no. 1443, 28" O.H., 90 h.p. units, pneumatic brakes, trolley pole, and controls, 48" t.g.
- 1-15 Ton HM629 G.E. Locomotive, 90 h.p. units, 44" O.H., 48" t.g., Excellent
- 14-15 Ton Locomotives, 250 Volt, any gauge
- 3-12 Ton 29B Goodman Locomotives, 40" O.H.
- 5-10 Ton Locomotives, 250 Volt, any gauge
- 14-8 Ton Locomotives, 250 Volt, any gauge
- 8-7 Ton Atlas Battery Locomotives
- 1-6 Ton Battery Locomotive—NEW
- 51-6 Ton Locomotives, any gauge
- 2-6 Ton Jeffreys, MH150 Locomotives
- 6-6 Ton MH80 Jeffrey Locomotives
- 1-5 Ton Locomotive, 250 Volt
- 15-4 Ton Locomotives, 250 V., any gauge
- 1-4 Ton 626A G.E. Battery Locomotive
- 1-4 Ton Waukegan Battery Locomotive
- 1-3 Ton Locomotive, 250 Volt

TIPPLE EQUIPMENT

- 1-4 Coll Jeffrey Beam Jig Washer
- 1-CMI Coal Dryer, 48" Excellent
- 1-Heat Dryer—Complete
- 1-Marion Double Roll Primary Crusher
- 1-24" x 36" Pa. Single Roll Crusher
- 1-36" x 36" Jeffrey Single Roll Crusher
- 1-24" x 36" Jeffrey Single Roll Crushers
- 1-18" x 12" Jeffrey Pulverizer
- 1-6" x 14" Double Deck Vibrator
- 2-4" x 12" Double Deck Vibrators
- 1-3" x 8" Low Head Vibrator
- 1-Jeffrey Traylor Vibrator Feeders
- 4-Jeffrey Traylor Vibrator Screens

- 1-Magnetic Separator, Complete
- 1-Bot Jeffrey Dewatering Screens
- 5-Scraper Conveyors of various sizes
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- 30-36" t.g. Drop Bottom Cars
- 200-42" t.g. End Dump Cars, Various makes
- 22-42" t.g. ACF, 6 ton Drop Bottom Cars
- 33-44" t.g. Drop Bottom Cars, 10 ton
- 100-44" t.g. Drop Bottom Cars, various sizes
- 180-44" t.g. End Dump Cars, various makes
- 330-46" t.g. S.D. Drop Bottom Cars, 22" O.H.
- 134-48" t.g. ACF Drop Bottom Mine Cars, 34" O.H.

RAIL AND WIRE

- 3,000—Tons 50, 60, 70 & 80 lb. Relying Rail
- 25,000—1,000,000 CM Fender Cables
- 875—800,000 CM Copper Feeder Cable
- 15,500—750,000 CM Insulated Copper Feeder Wire
- 8,500—500,000 CM Insulated Copper Feeder Wire
- 30,000—4/0 Stranded Highline Wire
- 60,000—4/0 Rubber Covered & Insulated Copper
- 40,000—6/0 Trolley Wire
- 40,000—4/0 Trolley Wire
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- 16,500—2/4 Transmission Wire
- 265,500—2/2 Solid Copper Transmission Line
- 30-Spools New Telephone Wire

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- 4-MKL Brown Fayo Car Spotters
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 - 1-WK30 Compressor, track mounted, self-propelled, 120 cu. ft. capacity, 48" t.g.
 - 2-Cantrill Compressors, 120 cu. ft. capacity, 48" t.g.
 - 1-Canton Trunk Cleaner, presently 48" t.g.
 - 9-Cleveland Slotters
 - 13-Slides for Mine Trucks
 - 22-Air Compressors of various sizes
 - 6-Dezers: D4, D6, D7 & D87
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- 1-Jay 12-BU Loader, 220 volt AC.
- 1-Jay 20-BU Loader, latest type.
- 1-Jay 11-BU Loader, latest type.
- 2-Jay 8-BU Loaders, 250 volt DC.
- 1-Jay 8-BU Loader, 34" overall height.
- 2-Jay 8-BU Loaders, 220 volt AC.
- 1-Jay curved Bar Head, complete.
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- 6-Reliance 24-J Motors 7½ H.P.
- 4-Reliance 10-J Motors 5 H.P.
- 3-Reliance 15-J Motors, 7½ H.P.
- 20-9-J Motors, 4 H.P.
- 6-New Wheel Units for Jay 65C Shuttle Cars.
- 1-Goodman 640 Loader on cats, excellent.
- 1-Goodman 640 Loader on cats, latest type.
- 1-Goodman 865 Loader, 26" high.
- 2-Jay 85C Shuttle Cars, rebuilt.
- 2-Jay 65C Shuttle Cars, rebuilt.
- 2-Jay 55C Shuttle Cars, rebuilt.
- 2-Jay 32E Shuttle Cars.
- 2-Jay 32E10 Shuttle Cars, rebuilt.
- 2-Jay 32E15 Shuttle Cars, rebuilt.
- 1-Jay 32E16 Shuttle Car, rebuilt.
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- 1-Jay 1-2-4 low pan Cat Truck with roof.
- 2-Jay T-1 Standard Cat Trucks, 220 AC.
- 1-Jay T-1 Standard Cat Truck, 250 DC.
- 2-Jay 11-8 Cutting Machines, like new.
- 1-Jay 7-8 Cutting Machine, like new, 250 volt DC.
- 2-Jay 7-8 Cutting Machines, 220/440 volt AC.
- 1-Goodman Machine on Cats, 31" high. All hydraulic.
- 6-Goodman 512 Machines with Bugdusters.
- 1-Goodman 512 Cutting Machine, perfect.
- 4-Goodman 512 Cutting Machines, 220/440 volt AC.
- 3-Goodman 112 Cutting Machines, 220/440 volt AC.
- 1-Lee Nurse low vein Machine Carrier on rubber.
- 1-Jeffrey 70 URB, rubber-tired Cutter, Universal head, perfect condition.
- 1-Jay 11RU Rubber Tired Cutter, first class.
- 1-Jay 11RU Rubber Tired Cutter with bugdusters. Universal head, like new.
- 1-Sullivan 7AU on rubber.
- 2-Jeffrey 29UC Cutting Machines, Universal head, cuts anywhere in seam, 38" high, on cats, 250 volt DC.

LOCOMOTIVES

- 1-Goodman 6 ton 91-A, 27" high armor plate frame.
- 3-Jeffrey 13 ton, type MH-110, 36", 42" and 44" Ga.
- 2-Jeffrey 10 ton, type MH-110, 42" and 44" Ga.
- 1-Jeffrey MH-124, 6 ton, 34" overall height.
- 12-Jeffrey, 6 ton, type MH-88, 42", 44" and 48" Ga.
- 2-Jeffrey, 8 ton, type MH-100, 2" armor plate frames.
- 1-Jeffrey, 6 ton, type 2186, 22" above rail.
- 3-Jeffrey, 4 ton, type MH-96, 42", 44" and 48" Ga.
- 1-G.E., 4 ton, type 825 Locomotive, 22" high.
- 10-G.E., 6 ton, types 801, 803, 821 Locomotives, 42", 44" and 48" Ga.
- 1-G.E., 8 ton, type 822 Locomotive, 44" Ga.
- 3-G.E., 10 ton, type 809 Locomotive, 42", 44" and 48" Ga.
- 2-Goodman, type 33, 6 ton, 44" and 48" Ga.
- 2-Goodman, 8 ton, type 32A, 36", 44" and 48" Ga.
- 3-Westinghouse, type 902, 4 ton, 42" and 48" Ga.
- 2-Westinghouse, type 904, 6 ton, 44" and 48" Ga.
- 2-Westinghouse, type 906, 44" and 48" Ga.
- 2-Westinghouse, type 907, 10 ton, 44" and 48" Ga.
- 8-Jeffrey MH-78 Locomotive Units, cheap.
- 3-Plymouth Diesel Locomotives, 8 and 10 tons, 42" and 44" Ga.

LOCOMOTIVES (Cont.)

- 4-Jeffrey MH-88 Locomotive Units, real bargain.
 - 6-Jeffrey MH-100 Locomotive Units, reasonable.
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- 1-Cedar Rapids portable super Screening Plant.
 - 1-Complete 5 track tippie with washer.
 - 1-Allis Chalmers 5'x14' Ripplie Vibrator.
 - 1-5'x14' Robins double deck Vibrator.
 - 1-4'x10' Robins Gyrex Vibrator.
 - 1-Roberts & Schaefer tandem Hydro-Separator.
 - 1-Belt Loading Booms.
 - 1-Robins Car Shaker.
- 10 Crushers, various sizes.
Feeders, Drag Conveyors and Loading Booms.

CUTTING MACHINES

- 1-Jay 11RU, rubber tired, Cutter.
- 1-Jay 10RU, rubber tired, Cutter.
- 1-Jeffrey 70 URB Cutter, rubber-tired, Universal Head, low vein.
- 2-Jeffrey 29UC Universal Machines on Cats.
- 1-JAU Sullivan on rubber.
- 1-Goodman on cats, 31" overall height.
- 3-Baby Goodman 212's, rebuilt, 250 volt DC.
- 1-Goodman 312, 18" high.
- 6-Goodman 312's with Bugdusters, like new.
- 4-Goodman 512's, rebuilt, or as removed from service.
- 4-Goodman 512's, 220/440 volt AC.
- 3-Goodman 112's, 220/440 volt AC.
- 2-Jay 7-8 Cutting Machines, 220/440 volt AC.
- 2-Jay 11B Cutting Machines, rebuilt.
- 6-Goodman 12AA's and 112AA's, 250 volt DC.
- 2-Goodman 324 Slabbers.
- 2-Goodman 724 Slabbers.
- 6-Jeffrey 331's, like new, 17" high.
- 2-Jeffrey 331's, on low vein trucks.
- 15-Jeffrey 358's and 358R's.
- 2-Jeffrey 298's on truck.
- 2-Jeffrey 29C's track mounted.
- 2-Jeffrey 29L's on truck, perfect.
- 2-Sullivan CE 220 volt AC.
- 2-Sullivan CR-10's, 13" high.
- 6-Jay 12BU with Piggy-Bag Conveyors.

LOADING MACHINES

- 16-Jay Loaders all types.
- 1-Goodman 865 Loader, 26", on cats.
- 1-Goodman 645 Loader, on cats.
- 1-Goodman 640 Loader, on cats.
- 2-Jeffrey 61 C18's on rubber, 26".
- 3-Jeffrey L-500 Loaders.
- 2-Myers Whaley No. 3 Automatic Loaders.
- 2-Clarkson Loaders, 26" above rail.

CONVEYORS

- 2-Jay 30" Underground Belt Conveyors, 500' to 2000' each. Excellent.
- 2-Goodman 97-C, 30" Conveyors, 1500' long.
- 1-Barber-Greene 30" Belt Conveyor, 350', Excellent.
- 1-Robins 30" Belt Conveyor, 500'.
- 1-Jeffrey 52-B, 26" Conveyor, 1200' each.
- 1-Jeffrey 52-B, 30" Drive and Tail Assembly, complete.
- 3-Robins 26" tandem drive Belt Conveyors, 1,000' to 2,000' long. Excellent condition.
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- 3-Goodman 97 HC 30" Drive and Tail Assemblies, complete.
- 8,000' Conveyor Belt, 30", like new.
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- 2-61EW Elevating Conveyors.
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- 2-100KW, G.E. TCC-6's, 275 volt, Rotary Converter.
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 - 1-200KW Allis Chalmers Rotary Converter, 6 phase, 275 DC, perfect.
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 - 1-200KW, G.E. HCC-6 Rotary Converter, 275 DC.
 - 2-300KW Westinghouse, 6 phase, Rotary Converters, 275 volt DC.
 - 1-375KW Westinghouse Rotary Converter, 275 volt.
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 - 2-200KW Westinghouse Rotary Converters, 275 DC.
 - (all the above with 6900/13000 and/or 2300/4000 primary transformers)
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 - 1-200KW MG Set, General Electric, perfect.
 - 2-150KW Allis Chalmers MG Sets, 275 DC volt, excellent, 220-440 AC volt.
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 - 2-300KW Westinghouse, 600 volt, 6 phase, Rotary Converters.
 - 2-300KW Westinghouse, 600 volt, DC, 6 phase, Rotary Converters.
 - 2-300KW HCC-6 Rotary Converters, 6 phase, 600 volt DC.
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20	G.E. S.B. Open	CD-85	1200
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7 1/2	West T.E.S.B. Shunt	SK-284	1800
7 1/2	West T.E.S.B.	SK-83	1800
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- 2-12BU-7E Joy Loading Machines, 250 Volts D.C.
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- 1-8BU Joy Loading Machines, 250 Volts A.C.
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- 1-66S Goodman Loading Mch. 250 Volts D.C.

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- 6-6SC-5E Joy Shuttle Cars, Elevating Discharge, 4 Wheel Steering, 250 Volts D.C.
- 1-6SC-3AE Joy Shuttle Car, Fixed elevated discharge, disc brakes, 34" high.
- 1-32E9 Joy Shuttle Car, dual tires and cable.
- 2-371-38 Goodman Shuttle Cars, 250 Volts D.C.
- 1-32E9 Joy Shuttle Car, 250 Volts D.C.
- 1-Jeffrey Shuttle Car, 4 wheel drive and steer.
- 3-42E18 Joy Shuttle Cars, Disc Brakes, Elevating Discharge, Completely Modern, 250 Volts, D.C. 2-Standard, 1-Opposite Standard Drive.
- 1-42E15A Shuttle Car, with 300' cable.

CUTTING MACHINES FOR SALE

- 5-11RU Joy Cutting Machines, 250 Volts D.C. with 9' Cincinnati Bar, Chain and bug-duster.
- 2-10RU Joy Cutting Machines, 250 Volts D.C. with bug-duster.
- 4-29UC Jeffrey Universal Cutters, Permissible, 250 Volts D.C.
- 3-512 Goodman Cutting Machines, 220/440 Volts A.C.
- 1-512 CCH Goodman Cutting Machine, 250 Volts D.C.
- 5-35B Jeffrey Cutting Machines, 250 Volts D.C.
- 6-35B Jeffrey Cutting Machines, 250 Volts D.C.
- 1-512AA Goodman Cutting Machine, 250 Volts D.C.
- 14-512DA Goodman Cutting Machines, 250 Volts D.C.
- 6-7B Sullivan (Joy) Cutting Machines 220/440 Volts A.C.
- 2-7AU Sullivan Cutting Machines, 250 Volts D.C.
- 1-124AA Goodman Slabber with One Lot of New Parts.
- 3-212AB Goodman Machines.
- 2-412AB Goodman Machines.

CONTINUOUS MINERS FOR SALE

- 3-4JCM Joy Continuous Miners, 440 Volts, A.C.

RECTIFIERS FOR SALE

- 1-General Electric, 300 KW, Stationary Rectifier, 2300/4000/4160 Primary and 275 Volts D.C. Secondary. Complete with switching equipment and associated controls. Latest type, like new.
- 1-300 KW Westinghouse Sealed Ignitron Mercury Arc Rectifier, 7200/13470 Volts, 3 phase, 60 cycle primary and 275 Volts D.C. secondary. Complete with switching equipment and associated controls. Latest type, like new.

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- 1-RBD 30 CP Roof Bolting Machine.

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- 3-Acme Self-propelled Air Compressors, 83R, Model 168, Capacity 176CFM, with 40 H.P. Balance Compound Motor. Excellent Condition.

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- 2-10 Ton Goodman Locomotives, Anti-Friction, Contactors, Modern.
- 2-15 Ton Goodman Locomotives, Anti-Friction, Contactors, Modern.
- 1-10 Ton Goodman Locomotive, Serial #4371 -Type 32A04-T, 250 Volt, D.C., 42" track gauge. Height 34".

ROCK DUSTERS FOR SALE

- 1-MSA Track Mounted Rock Duster, 10 H.P. A.C. or D.C., high pressure, 30" high, any gauge.
- 2-MSA Bantam Rock Dusters, Rubber tired, portable.
- 2-MSA Bantam Rock Dusters, Skid Mounted.
- 1-American Mine Door, Wheel mounted bantam type rock duster, 250 Volts, D.C. 22" high.

HOISTS FOR SALE

- 2-CHD Joy Car Spotting Hoists, 10 H.P. Permissible.
- 10-211 1/2 Vulcan-Danver Material Hoists, Complete with 3 H.P. D.C. Compound Wound 1750 RPM General Electric Motor.
- 2-Brownie Hoist, Model HKL-good condition.
- 1-Brownie Hoist, Model HKM-good condition.

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- 2-Jay P111-16 Elevating Conveyors.
- 2-Barber-Greene Self-Propelled Elevators, 30' long, gasoline or electric.
- 1-Barber-Greene Self-Propelled Cat Mounted, self loading-gasoline driven.

CAT TRUCKS FOR SALE

- 1-T2B-SAPE Joy Truck, 250 Volt D.C. Permissible.
- 2-T1 Joy Trucks, A.C.
- 2-T2-SAPE Joy Cat Trucks

CHAIN CONVEYORS FOR SALE

- 1-500' Long Conveyor, Model 400D-Complete with Drive, Fan & Chain.
- 1-61WH Jeffrey Chain Conveyor, 450' long. Complete with 20 H.P. D.C. Motor.
- 5-61AM Jeffrey Chain Conveyors, 10 H.P. 300' long.
- 3-61HG Jeffrey Chain Conveyors, 5 H.P. 40' long.

DIESEL PLANTS FOR SALE

- 1-75 KW Diesel Generator Unit, with Buda Diesel Engine and 75 KW Generator.
- 1-100 KW Diesel Generator Unit, with G.M. Diesel Engine and 100 KW Generator.
- 1-D13000 Caterpillar Diesel Generator Units -with caterpillar engine and 75 KVA Louis Allis generator self regulating.
- 1-60 KW General Motors Diesel Driven Generator Set, 250 Volts, D.C., Direct Connected, Complete with switchgear.

MOTOR GENERATORS FOR SALE

- 1-300 KW Westinghouse Motor Generator Set, synchronous motor, 435 KW Output, 435 KVA, 2200 Volts, 1200 RPM, D.C. generator 300 KW, 275 Volts, 1200 RPM. Compound Wound, Complete with D.C. panel and switch gear.
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- 1-150 KW Westinghouse Motor Generator Set, 2300 Volts A.C., 275 Volts D.C. Complete with switching gear.
- 4-50 KW G.E. & Westinghouse Motor Generator Sets, 2300 Volts A.C., 275 Volts D.C. Complete with switching gear.
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- 1-200 KW Ridgeway Motor Generator Set, Complete with switchgear and 1600 amp. I-T-E automatic circuit breaker, 2300 A.C., 275 Volts D.C.

MISCELLANEOUS FOR SALE

- 100-AC&F 7 Ton Capacity 42" Track Gauge Drop Bottom Mine Cars.
- 1-24" Fan with drive.
- 2-7 1/2 H.P. Tricycle Type Rubber Tired Mine Tractors, 220 Volt Single Phase Motors or 250 Volt D.C. Motors.
- 90-AC&F 3 ton Capacity 42" Gauge, Drop Bottom Mine Cars 26" High.
- 150-Sanford Day 3 Ton Capacity Bottom Dump Mine Cars, 42" Gauge, 40" High.

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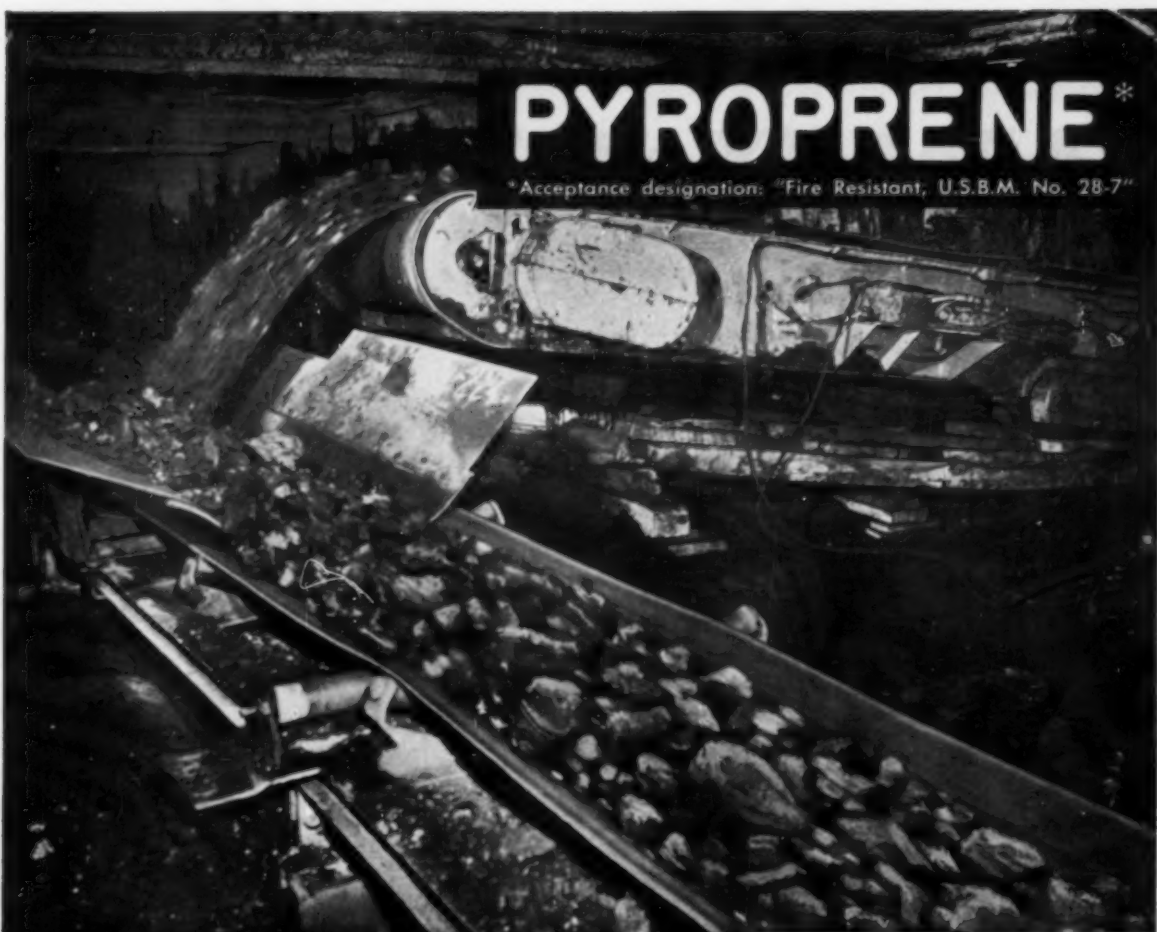
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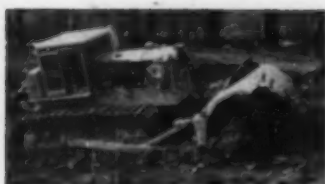
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Many features contribute to economy with the D9. The exclusive Caterpillar oil clutch can operate thousands of hours without adjustment; the track rollers, with bushing-type bearings, require less service time; and there's extra protection with Caterpillar's hydraulic track adjusters because the right tension can easily be maintained on the tracks.

Available with either torque converter or direct drive, the D9 is ready to give you the most economical big-volume production you've ever experienced. Ask your Caterpillar Dealer to demonstrate this massive prime mover at your mine. And remember, you can depend on him for prompt service and quality Caterpillar parts.

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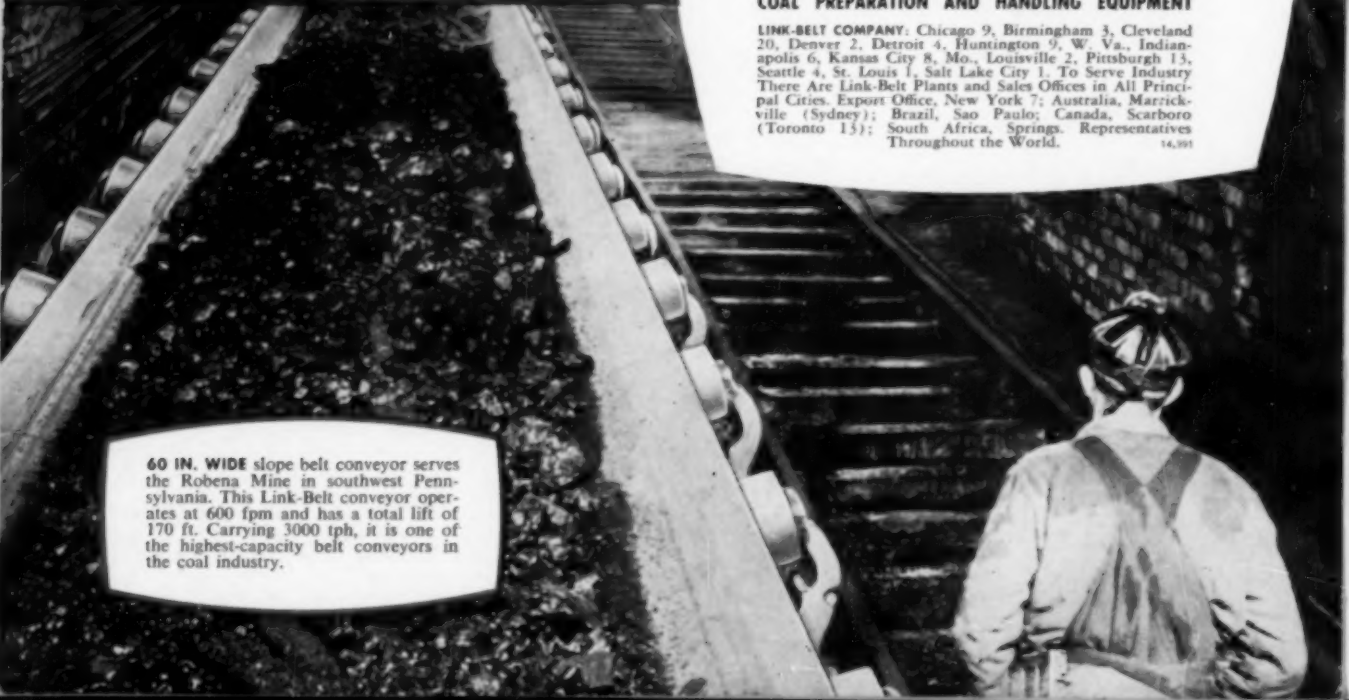
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